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DAIRY, FOOD AND ENVIRONMENTAL

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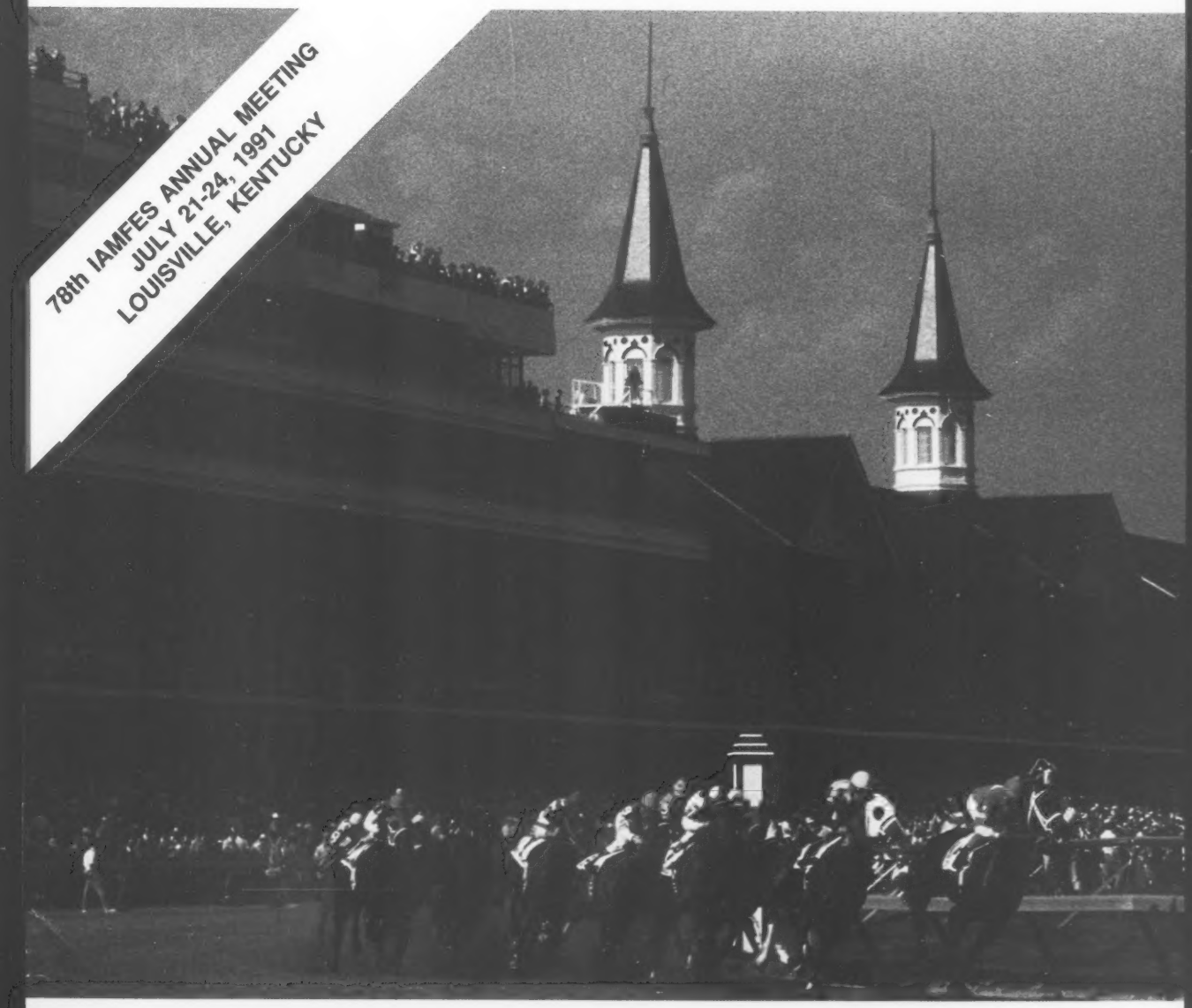

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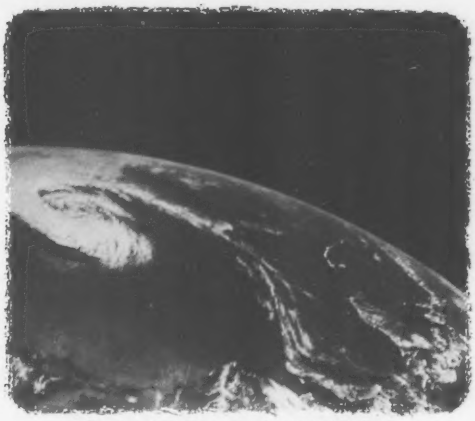

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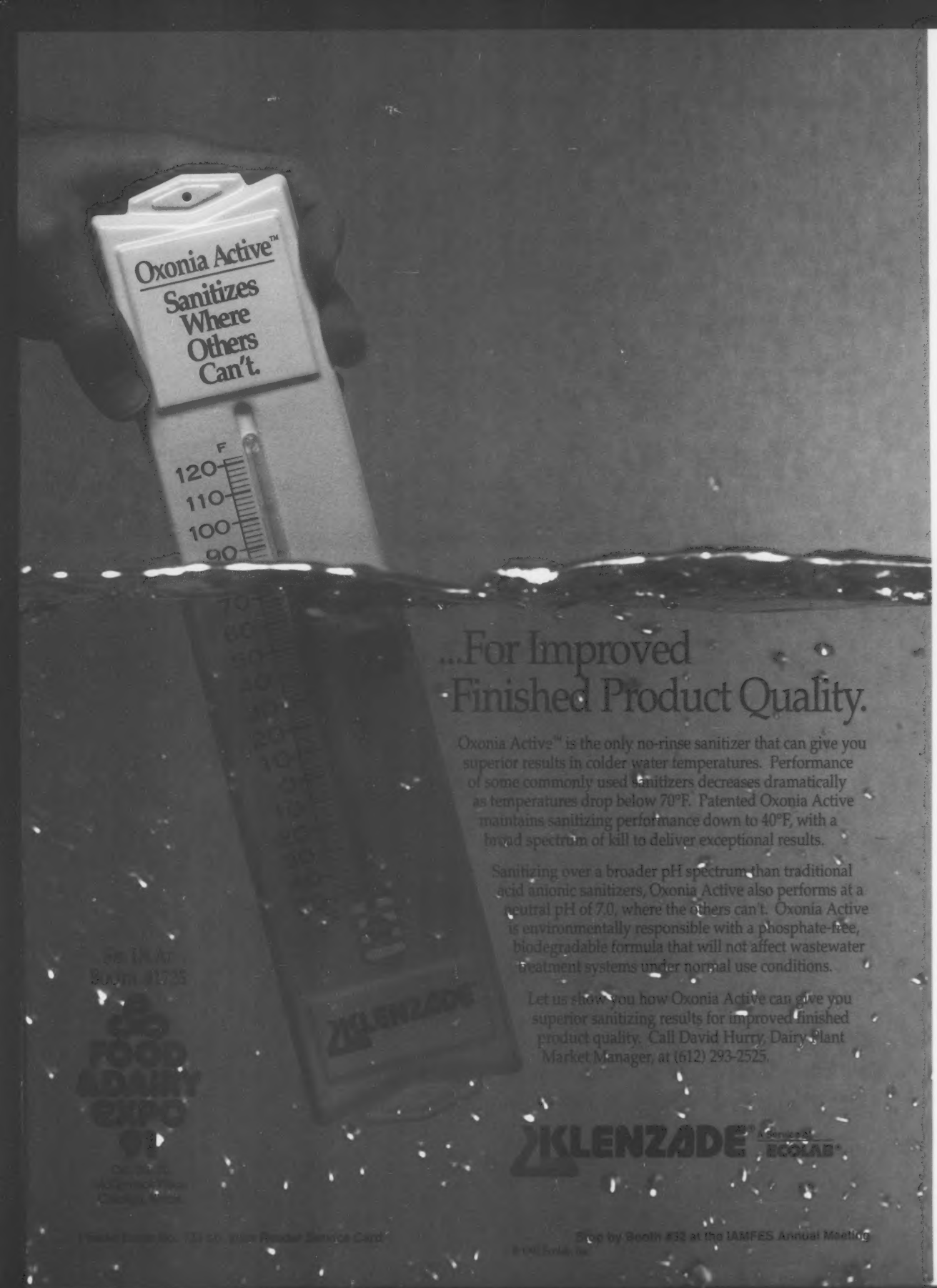

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Thoughts From The President . . .

By
Bob Sanders
IAMFES President

It's that time again. Time to write the monthly column. It doesn't seem like it but this will be my last column. By the time you read this it will be almost Annual Meeting time. Where has the time gone? I will be turning over the reigns to President-Elect Damien Gabis at the close of the Annual Meeting. This past year has been most enjoyable for me to serve as your president. I consider it one of the highlights of my career to have been elected by you, my peers, as president of the greatest Sanitarians' organization in the world.

Speaking of elections, I would like to announce that the winner of this year's election for Secretary is Dee Clingman. Welcome aboard Dee. I'm sure the Executive Board and the membership will profit from your contributions during the next 5 years.

The ballots for the name change have been counted. The results show that you have overwhelmingly chosen to keep the present name of International Association of Milk, Food and Environmental Sanitarians, Inc. (IAMFES) as the official name for this organization.

Final plans are being completed for the Annual Meeting. It's still not too late to register for the Annual Meeting. It looks like the pre-meeting workshop on "Procedures to Investigate Foodborne Illness" will be a go; we will have enough registrants to at least break even.

Since this is the last president's thoughts that I will be writing I would like to take this opportunity to thank the many people who have assisted me through my four years on the Executive Board. The present Executive Board, President-Elect Damien Gabis, Vice President Mike Doyle, Secretary Harold Bengsch, Past President Ron Case and Affiliate Chair Ron Schmidt. Also Past Presidents Bob Gravani, Leon Townsend and Roy Ginn, and Bill Coleman who served as Affiliate chair during my first three years on the Executive Board. All of these people are hard working and dedicated individuals who have assisted in making your organization run smoothly and be what it is today, the greatest Sanitarians' organization in the world. Thanks also should go to Gale Prince who was Chairperson of the Program Advisory Committee last year when I was responsible for the technical portion of last year's Annual Meeting. Special thanks should go to Steve Halstead, Margie Marble, Scott Wells, Julie Heim, Dee Buske and the others on the staff at the Ames office. Steve, with his experience in working with associations, has brought many new ideas to the board and has contributed much to IAMFES during the two years that he has been our Executive Manager.

Another group that I wish to thank are the Chairpersons of all of the Committees of IAMFES. Again these hard working and dedicated individuals are what make IAMFES work and produce results. Lloyd Bullerman and his assistants who put the Journal of Food Protection together each month deserve a special thanks. This Journal has no equal when you are looking at publications dedicated to food protection.

That's about all of the news that I can think of from this end. See you in Louisville on July 21st.

On My Mind . . .

By
Steven K. Halstead
IAMFES
Executive Manager

is the 1992 meeting...

Toronto. Taking an idea from President Sanders, I am writing this on my way back from Toronto. Michael Brodsky and I have just finished putting the final negotiations together for the headquarters hotel for the 1992 meeting. This is my third trip to Toronto in the past two years and will probably be followed by at least a couple of more visits by the time our meeting begins in July.

Each time I visit, I come away impressed with the city. It is so cosmopolitan, so clean, so friendly, so neat. New York City, the standard by which we tend to measure cosmopolitanity has a great deal to learn from Toronto.

Is it possible that Toronto represents the city of the future where all races and creeds can live together in unity and peace?

My experiences in NYC have led me to conclude that while on paper it is a racially mixed city, in reality it isn't. In NYC you travel from one cultural/racial neighborhood to the next. Within that neighborhood, you find great homogeneity and very little mixing.

Not so in Toronto. There are still the neighborhoods, but they seem to be much more diverse. Walking down the street, you are liable to hear all kinds of languages (I was going to say foreign languages, but it suddenly struck me that I am the foreigner here) and see all colors of people. All mixed up with no one group seeming to predominate.

They seem to live in unity, if not perfect unity. In reading the newspapers and watching the TV news, I have yet to see or hear of the kind of racial unrest we are so accustomed to here in the States. (That's another thing--by habit I refer to myself and my countrypersons as "Americans". Obviously, Canadians, Mexicans, Brazilians, etc. are also "Americans". Luckily, Canadians are great hosts and take no pleasure in reminding me of this fact when I slip up.)

There is TV programming in French, Chinese, Japanese, Spanish, Vietnamese, and several other languages I was unable to identify. Try as I may, I just couldn't get into "Happy Days" where Fonzy, Richie, Ralph, et al were speaking French.

Is it possible that Toronto represents the city of the future where all races and creeds can live together in unity and peace? If this is the future, then there is hope for this world. Otherwise....

Toronto is such a friendly city, that it's easy to forget that you are in a foreign country. Seeing the Canadian flag flying instead of the Stars and Stripes helps, but what really brings it home is to see Bud Light listed under "Imported Beers".

I would be remiss if I didn't talk about crime in Toronto. Toronto is not a crime free city, but it is delightfully close. When I mention crime, the residents immediately talk about the spree of murders that is taking place. As of late May, they have had a total of 53 murders. The people are up in arms and are publicly demanding that the authorities do something. Legislation calling for stricter gun control has been introduced, and police patrols have increased markedly. How many cities in the States having a population exceeding 3 million can claim this level of citizen protest over 53 murders in 6 months?

July, 1992 seems like such a long ways off, but I encourage you to begin planning now to attend. It promises to be an outstanding educational experience in a city whose beauty and hospitality will knock your socks off.

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Hazard Analysis Critical Control Point (HACCP) Identification

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For twenty years, the food industry has reviewed the HACCP concept or various programs with similar meanings. Today, the food industry is using labor saving methods of shifting the quality responsibilities upon the operating line personnel. Rightfully, this is where food quality should always be if waste and cost savings are demanded. The problem occurs when emphasis on getting products out and meeting quotas become more important than carefully examining each HACCP step. Then it is up to the Quality Assurance personnel to catch those batches which pass through the system. It is like looking for a needle in the hay stack! Unfortunately, some of those quality blemishes are encountered by the consumer or product purchaser.

The FDA has promoted utilization of the HACCP inspection technique as illustrated by a presentation (1) before the Food and Drug Law Institute in cooperation with FDA, Washington, D.C., December 11, 1973. FDA considered the HACCP program as an investigative tool. It gave the inspector advanced knowledge of where to look when making an inspection of any industry prior to starting the investigation. It allows that individual to determine the extent of the food industry's own quality control program covering the critical control points. Lastly, it documents the ability of the firm to adhere to its own quality control program.

Strange as it may seem, twenty years later, food firms are still searching for the training means to make the HACCP program totally workable in their operation. Perhaps, it is simply because there are so many points required to be encompassed in the main concerns. For example:

1. Biological - problems include infestations by insects; rodents; birds. Problems include pathological; parasitic; yeast and molds.
2. Chemical - problems caused by lubricant contact; pesticides; cleaning/sanitizing compounds; and maintenance items such as plastics, caulk, adhesives, rubber, inks, boiler and water additives.
3. Environmental - problems related to surroundings of food; food ingredients; package supplies and materials; exposure of foods to open and exposed conditions; excessive heat, moisture, or cold temperatures; odors can be absorbed.
4. Physical Conditions - problems of wear points, rust, corrosion, peeling paint occurring internally within equipment.

A flow diagram for every production or product line with thought given to each of the above points is essential for the identification and training of personnel for such situations. Particular written documentation should be made on each sifter of screener tailings; magnet inspections and testing of strength; metal detector rejects; thermometer readings or gauge charts; moisture additive meters; scale weight checks; X-ray scanners; color determination through photometry; and any other mechanical device that may qualify the product safety ought to be maintained in the event a question should arise later in the movement or flow of the materials.

Monitors as mentioned above allow Management or Quality Assurance to make decisions on a "Go or No Go" basis. Sometime identified or potential hazards can be eliminated or corrected. Limits can be established or variances made upon documented findings. Established limits for safe processing can be better maintained. Documentation establishes how well critical limits are being enforced.

In 1981, Mr. F.C. Majorack (2), Assistant Director for Quality Assurance, Bureau of Foods, Food and Drug Administration, Washington, D.C., brought out an expanded concept of the Cooperative Quality Assurance Program (CQAP) with an Industry Quality Assurance Assistance Program (IQAAP) whereas the "Quality Dyad" term was used. A simple definition means the joining together of two co-equal operations. This might be illustrated by Quality Assurance and Sanitation or Environmental Safety, each operating in its own sphere, but interdependently with the other. Quality Assurance receives frequent line samples starting with ingredients, in process, and finished product and keeps the specification of the foods intact. The package integrity and all therein must represent the Company's reputation. Sanitation or Environmental Safety charts policy, prepares plans, conducts audits and provides training.

While the Industry Quality Assurance Assistance Program (IQAAP) focused on many of the HACCP items, it also encompassed additional points such as Package Control by checking on labeling and lot coding; Storage Requirements; and a Recall Plan.

The National Restaurant Association promoted a Sanitary Assessment of Food Environment (SAFE) (3) for their group. That program entailed a triple approach to safe guarding foods. Self inspections by using an Inspection Report Form (IRF); HACCP identifies the process flow steps

where contamination could arise; and SAFE is the self regulation and liaison between the quality of food environment and the status of health. Overall, the element of good food selection; the benefits of what the food nutrition gives the consumer; and long range well being that the individual gets from proper nourishment of such foods would be the lasting results of the program.

Another program which Borden Inc. points to with pride is the SQP plan. The basic ingredient was the acronym, SQP which stands for Safety, Quality, and Productivity. The lowering of the reportable accident rate quickly translates into big dollar savings. The plan has been around for several years in the dairy plants and was offered to the employees as an idea for them to accept or reject. All in all, it seemed to make sense and they took hold of the plan. A commitment by management at the top which kept the program motivated was generated. Employee/management teams were established where goals and how to meet them were resultant. This further heightened the involvement with all the plant people. The support from the labor unions thus evolved. An incentive system was designed where reaching a goal was rewarded both monetarily and through pride in achievement. The emphasis was set on measurable results and goals which were challenging, but not unreachable (4).

More terms for food handling protection can be related to the meat inspection program in that Critical Control Points (CCP) are identified where a process or procedure can be changed or controlled to assure that the product remains wholesome and not adulterated. Monitoring Activity (MA) is the systematic collection and recording by establishment personnel of an observation at a critical control point with a predetermined frequency to ascertain if the process is under control by comparing the observation to the process control limit. Process Control Limit (PCL) is used to control the process and assure that a wholesome and unadulterated product is produced (5).

The Philip Crosby Associates, Inc.(6), directed by Philip B. Crosby, perhaps discussed certain features of Quality demanded by companies in a most illustrious manner. Some companies advocate an Acceptable Quality Level (AQL) when they should be targeting a Zero Defect. "The realization that Zero Defect is paramount then makes Quality a part of the fabric of the company." "The cornerstone of Quality is prevention." "Quality means conformance to requirements." "Quality is attention to detail." These statements are for management to get action going. It all starts at the top and what managements wants; management will get.

Debra Levine with the Deming Method Consulting Group (7) offers this technique to make HACCP or Quality workable. In brief, she suggests three elements:

A. Management's direction to achieve the quality improvement.
   1. Creating the proper environment - Communication improvement is a prerequisite as the worker must understand exactly what is expected. The parameters must be the same time after time. Utilize the workers' expertise by getting their suggestions. In turn, they become a participant in the process. Respond promptly to problems and concerns. Allow some decision making in their findings or recommendations. Always give the worker professional respect.

B. Defining the hazard and/or critical control point.
   1. Outline the process or production activities.
   2. Identify the equipment and point for inspection.
   3. Types of foreign material or objects which might be encountered might be illustrated.
   4. Anything other than normal product extractions should be brought to the attention of the immediate supervisor.
   5. Anything other than normal product which cannot be immediately identified by the supervisor must be brought to the attention of Q.A./Sanitation Safety.

C. Critical measurement characteristics.
   1. Written documentation.
   2. Determination of the source of anything foreign within the system.
   3. Corrective actions for prevention.
   4. Internal recall of product for destruction or intensified sampling.
   5. Management's accommodations to the crew which first identifies a variance from norm.
   6. Utilization of experiences to other members of critical control points on how losses were minimized and customer confidence in the product quality can be maintained.

The process of Hazard Analysis Critical Control Points (HACCP) can be modified to each Food Industry's specific needs, but the basics are virtually the same. The quest for wholesome unadulterated products for the consumer generates sales and returned satisfied customers. By and large each customer inspects the food to be prepared or eaten with a great deal of expectation that it is the best that money can buy. Dissatisfaction or not meeting the expectation of that customer, quickly removes your product from their shopping list. Advertisement and publicity might get the buyer to try the merchandise the first time, but the quality must be built into the food. HACCP is workable. Zero defect is obtainable. Make the effort and the employee can become your best inspector and first line of defense in your Quality Assurance/ Sanitation, Environmental Safety program.

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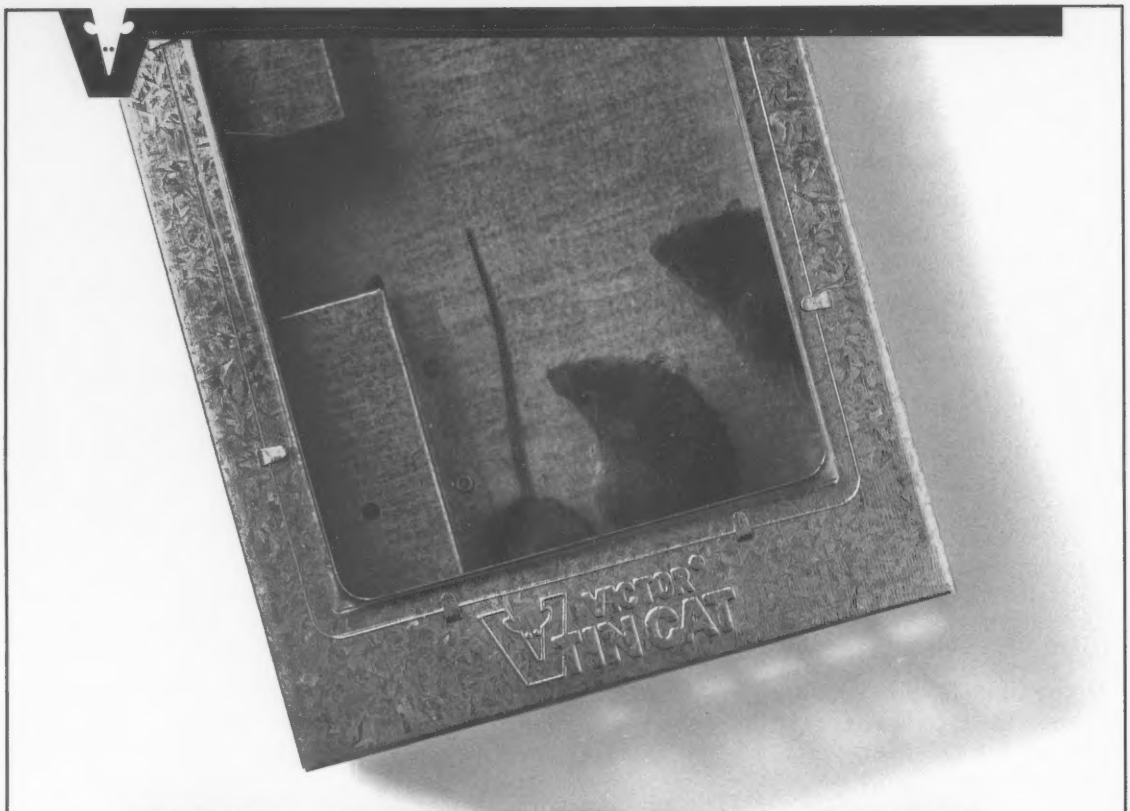

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Isolation of Luminescent Bacteria From Cooked Seafood Products

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Abstract

There are numerous reports in the literature concerning the presence of luminescent bacteria in raw seafood products, but to our knowledge no studies examining the nature of luminescence in cooked seafood preparations have been published. This investigation summarizes a two-year study of luminescent cooked seafood products purchased by consumers and subsequently submitted to a U.S. Food and Drug Administration's microbiological laboratory located in Bothell, Washington. The products involved were cooked and peeled shrimp and imitation crab meat. As a result of these analyses, two luminescent bacteria, *Photobacterium phosphoreum* and *Vibrio logei* have been isolated.

Introduction

In 1989 and 1990 there were seven complaints and five inquiries by consumers from the states of Alaska, Arizona, California, Florida, Kansas, Minnesota, and Washington concerning cooked seafood products which glowed in the dark. The consumers discovered their cooked seafood luminescing in various situations, such as in refrigerators with burned out light bulbs, in imitation crab meat sandwiches about to be eaten as midnight snacks, imitation crab meat used as pet turtle food, and in cooked and peeled shrimp fed to cats as a special treat. At the times, potential explanations for the observed phenomenon were fluorescence, radiation and phosphorescing phytoplankton. Some of the consumers kept these cooked seafood products several days past the indicated expiration dates. In other cases, the grocery stores neglected to remove outdated seafood from their display cases. Some of the cooked seafood products not only emitted a blue-green light, but were also decomposed on the day of purchase.

Currently, there are two identified nonmarine species of luminescent bacteria, *Xenorhabdus luminescens* and *Vibrio cholerae* biotype albensis (4); and nine marine species, *Photobacterium phosphoreum, Photobacterium leiognathi, Alteromonas hanedai, Vibrio logei, V. fischeri, V.harveyi, V. splendidus* I (4), *V. vulnificus* VVLI (3,4,7,8) and *V. orientalis* (9). Luminescent bacteria are found in seawater, marine animals, raw shellfish, fish and also in specialized light organs of teleosts. *Photobacterium phosphoreum* is observed typically in deep seafish. *Photobacterium leiognathi* most often occurs in temperate and tropical fish (7). In 1986 Dr. James Oliver of the University of North Carolina at Charlotte reported on a bioluminescent strain of *Vibrio vulnifcus* VVLI. This microorganism was isolated from a 72 year old man who had received a puncture wound in his leg while cleaning fish on the Gulf of Mexico. This man died thirteen days later after being admitted to a hospital (8). This report was the first indicating pathogenicity from bioluminescent bacteria. Previously, luminescent bacteria had been considered harmless to man (2).

To investigate the basis for the current series of consumer complaints, a study of luminescent cooked seafoods was undertaken to isolate and identify microorganisms involved in this phenomenon. As a consequence of this study, two luminescent bacteria, *Photobacterium phosphoreum* and *Vibrio logei*, were isolated.

Materials and Methods

Materials. Marine broth 2216, glycerol, yeast extract, tryptone, motility test medium, purple broth base, glucose, maltose, mannose, sucrose, trehalose were obtained from Difco (Detroit, Michigan). Calcium carbonate was obtained from Mallinckrodt (Paris, Kentucky). Phenol red carbohydrate broth was purchased from BBL (Cockeysville, Maryland). Imitation crab meat from a variety of different sources was used to supplement the growth media and agar. Sodium chloride was added to motility test medium (1%), purple broth base (2%), and phenol red carbohydrate broth (2%).

Method. The enrichment broth used was imitation crab broth (ICB) and consisted of the following (per liter): Difco Marine broth 2216 (1), 37.4g; glycerol, .3% (v/v); yeast extract, 5g; tryptone, 5g; calcium carbonate, 1g (4); 25g of imitation crab meat blended with 25 ml of distilled water; and 975 ml distilled water and adjust pH to 7.6 +/-.2. The broth was autoclaved for 15 minutes at 121°C. Imitation crab agar (ICA) similarly was prepared as ICB except that 15g of agar was added. For biochemical assays, glucose, maltose, mannose, sucrose, and trehalose were filter sterilized and added to phenol red carbohydrate broth plus 2% salt. (Difco's purple broth base may be substituted for the phenol red carbohydrate broth.)

Duplicate 25 gram portions of product were weighed into two jars of ICB containing 225 ml each. One jar was

incubated at 10°C and the other at 25°C. Both enrichment broths were streaked onto duplicate ICA plates after 24 and 48 hours of incubation. One set of plates was incubated at 10°C and the other at 25°C. The agar plates were examined in a dark room. It took approximately 5 to 6 minutes for the eyes to become adjusted to the darkness. Once the luminescent bacteria were isolated, they were easily identified by standard procedures including biochemicals, gram stains, motility, anaerobic growth, and growth assessment at various temperatures (4).

Results

Five isolates from each complainant's seafood product (cooked and peeled shrimp or imitation crab meat) were selected for identification. In six of the seven cases *Photobacterium phosphoreum* was isolated. These bacteria were plump gram negative, motile or nonmotile, facultative rods. *P. phosphoreum* produces acid and gas in glucose, mannose and maltose and grows at 4°C but not at 35°C. *P. leiognathi* produces only acid in glucose and mannose; does not utilize maltose, grows at 35°C but not at 4°C (4).

The data for the isolates matched the data in the literature for *Photobacterium phosphoreum* and are presented in Table 1.

Table 1. Comparison of data collected in this study with data from the literature (4)

Characteristics	Isolates	P. phosphoreum	P. leiognathi	Vibrio sp.	A. hanedai	X luminescens
Gas from glucose	+	+	-	-	-	-
Growth at 4°C	+	+	-	see Tab. 2	+	-
Growth at 35°C	-	-	+	see Tab. 2	-	+
Motility	-	+/-	+/-	+	+	+
Utilization of:						
glucose	+	+	+	+	+	+
maltose	+	+	-	+	-	-
mannose	+	+	+	+	-	+
sucrose	-	-	-	see Tab. 2	-	-
trehalose	-	-	-	see Tab. 2	-	-
Strict aerobe	-	-	-	-	+	-
Facultative anaerobe	+	+	+	+	-	+

In one of the seven cases *Vibrio logei* was isolated from cooked and peeled shrimp. The luminescent *Vibrio* sp. are slightly curved to straight, gram negative, facultative rods; produce acid but not gas in glucose, mannose, and maltose. *V. logei, V. splendidus* I (4), *V. orientalis* (9), grow at 4°C *V. harveyi, V. splendidus* I, *V. fischeri* (4), *V. vulnificus* VVLI (8) and *V. orientalis* (9) grow at 35°C. The data for the five isolates matched the data in the literature for *Vibrio logei*, and are presented in Table 2.

As indicated in Table 2, the five isolates did not produce gas in glucose and only grew at 4°C. In addition, more than one strain of luminescent bacteria was isolated from an individual product. Examples included a preparation of cooked and peeled shrimp obtained from a fish broker and also a package of imitation crab meat purchased from a grocery store. In these instances two strains were isolated, *Photobacterium phosphoreum* and *Vibrio logei*.

Table 2. Data from the Literature

Characteristics	V. cholerae albensis (4)	V. harveyi (4)	V. vulnificus VVLI (8)	V. splendidus I (4)	V. fischeri (4)	V. logei (4)	V. orientalis (9)
Growth at 4°C	-	-	-	+	-	+	+
Growth at 35°C	+	+	+	+	+	-	+
sucrose	+	d	-	+	-	-	+
trehalose	+	+	+	+	d	-	+

(d) 11-89% of strains are positive (4)

Discussion

Luminescence by bacteria is due to a chemical reaction catalyzed by the enzyme luciferase with the oxidation of a reduced flavin mononucleotide and a long chain aliphatic aldehyde in the presence of molecular oxygen. The products of the reaction are oxidized flavin, fatty acid and light (4,5,10).

Most of the complaints involving luminescence that served as the basis for this study were due to cooked and peeled shrimp and imitation crab meat. These products are commercially packaged in 2.5 and 5 lb. plastic bags, but then repacked into smaller units by retailers, such as fish markets and grocery stores. Frequently the presence of luminescent bacteria coincided with either low quality or decomposed cooked seafood products. Thus far, *Vibrio vulnificus* VVLI is the only opportunistic pathogen identified that luminesces (8).

In this two year study involving 7 complaints, two luminescent strains of bacteria were isolated, *Photobacterium phosphoreum* and *Vibrio logei*. The consumers who purchased and ate the "glowing" imitation crab meat and cooked and peeled shrimp did not suffer any ill effects. Since luminescent bacteria are naturally occurring in seawater, fish, shellfish and marine animals, they should not be present on cooked seafoods. In fish markets and grocery stores, good sanitation practices should be followed to prevent cross contamination of raw and cooked seafood products. An example of a poor retail practice was the draping of raw inshell shrimp over a container of cooked and peeled shrimp.

Therefore, it is reasonable to conclude that if good sanitation practices are utilized, the frequency of occurrences where consumers note their seafood purchases to glow in the dark, can be effectively minimized.

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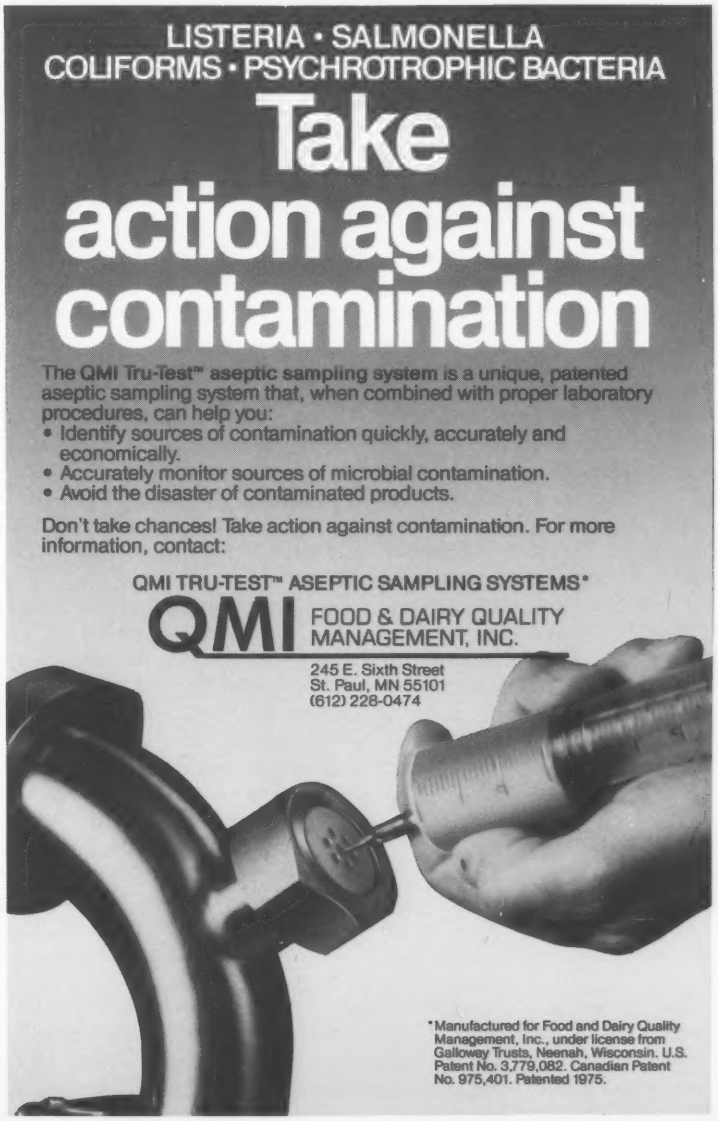
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Shelf-Life Evaluation Analysis

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As consumers we all have encountered examples of foods that are obviously spoiled--moldy bread, soured milk, bad fish and what sometimes happens to those leftovers hiding in the lower back corner of the refrigerator. These encounters may be humorous or repulsive. If the food was eaten first, a negative physiological or psychological reaction may have followed. If pathogenic organisms were present, the consequence may have been an unforgettable bout of some uncomfortable gastrointestinal malady. In some, fortunately rare cases, foodborne pathogens may be deadly. Unfortunately, the presence of pathogens is not always signalled by food spoilage. The risk of an encounter with either spoiled or dangerous foods can be significantly reduced by knowing and understanding shelf-life and stability.

Shelf-life represents the useful storage life of food. At the end of shelf-life, the food is developing characteristics such as changes in taste, aroma, texture, or appearance that are deemed unacceptable or undesirable. The underlying cause for the change may be microbiological, chemical, or physicial. Microbiological spoilage is exemplified by the encounters cited above. Chemical and physical deterioration are characterized by the examples of rancidity and freezer burn.

Establishing the microbiological shelf-life for many foods becomes important at some point in its history. The determination may be required early in its history, during product development, late in its history, after it has been established on the market, or at some time in between. The reason for determining shelf-life may range from product design goal, to formulation change, to packaging or storage change, to changes in microbiological criteria, or a simple desire to know. Regardless of the when or why, numerous variables must be considered in the experimental design of the shelf-life study in order to approach a useful result. The variables and guiding principles for selecting among study options are the focus of this article.

Identifying Foods Susceptible to Microbial Spoilage

Microorganisms have specific growth requirements for temperature, moisture, acidity, nutrients, and time. For microorganisms to grow, cultural conditions must be within a certain range and if minimum conditions are not satisfied, growth will not occur.

In general, organisms grow at temperatures between 0 and 55°C, at pH values between 2 and 10 and at water activity levels about 0.6.[1,2,3] These limit ranges are not absolute and the boundaries around them are not usually sharp. Optimal growth generally occurs in the middle region of the various ranges and slows as the boundaries are approached. In most foods, nutrients are not limiting, but inhibitory substances may block proper utilization of the food. Oxygen is required for the growth of some organisms, for others it is optional, and to others it is a poison. Oxygen and other gases are available from the atmosphere or from air trapped in the product. By manipulation of the food's composition, pH, water, acidity, etc., different groups of organisms are either activated or inactivated and their growth rates are either accelerated or slowed. Assessing a food item in terms of its microbial growth requirements makes it possible to determine its potential for spoilage. However, studies are generally required to confirm expectation.

Organoleptic Determination of Shelf-Life

The taste, odor and appearance of a food are the ultimate criteria used by consumers to judge a food's acceptability. In the laboratory also, an organoleptic evaluation of a food is a direct method for determining shelf-life. The food is prepared and periodically examined for changes in appearance, aroma, texture, and taste until it becomes unacceptable. The organoleptic determination is easily accomplished by those familiar with the desired characteristics of the product. Shelf-life based on organoleptic analysis, however, may vary significantly from consumer to consumer since tastes, expectations, and ability to detect changes differ greatly.

Microbiological Criteria for Shelf-Life

The organoleptic quality of food changes as its microflora—bacteria, yeast, and mold—grow and metabolize available nutrients. The sensory changes at first may be subtle, but eventually the changes cause the food to become unacceptable. Generally, sensory changes are not detectable until the microbial population is high. The number of organisms required to cause spoilage varies with the food item and the type(s) of microorganisms growing in it. Shelf-life may be estimated on the basis of microbial density. As a rule of thumb, 10,000,000 bacteria per gram, 100,000 yeast per gram, or visible mold are used to estimate the end of microbiological shelf-life. Noticeable degradation of the product is likely to occur at these levels. Whether the changes are acceptable or not is determined by the organoleptic evaluation.

High numbers of microorganisms are normal in certain foods, but are a sign of deterioration in other foods. Therefore, it is desirable to know, even in the absence of objectionable organoleptic changes, the microbiological state of food as it nears the end of shelf-life. For the delivery of a product with

Cont. on p. 366

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maximum quality, the shelf-life of a product should be determined by organoleptic and microbiological examination.

Design Considerations for Microbiological Shelf-Life

Many factors must be considered in the design of each microbiological shelf-life study. Among these are temperature, water content, time, types of microorganisms, suitability of analyses, sampling, and replication. Shelf-life studies for each product should be designed specifically because of the number of variables which must be considered.

Temperature

Of the factors influencing microbial growth—water, acidity, temperature, nutrients, preservatives, and atmosphere—all but temperature become essentially fixed at the time of product formulation, processing, and packaging. Normally, these factors are not intentionally altered in a shelf-life study. Storage temperature usually determines the length of microbiological shelf-life of perishable foods.

In general, as the temperature increases, the microbial growth rate increases. At temperatures near freezing, organisms either grow very slowly or not at all. As the temperature increases toward the optimum, metabolic activity and growth rate increase. At this temperature, growth is fastest. As the temperature increases beyond the optimum, the growth rate begins to slow. At some maximum temperature, growth stops and higher temperatures begin to kill the cells. Each species of organism has a different minimum, optimum, and maximum growth temperature range. Moreover, differences may be observed among isolates of the same species. The important point about temperature and growth is that when the storage temperature of a product changes, not only does the shelf-life change, but the spoilage flora will also likely change.

Because of the important relationship between growth rate and storage temperature, the most useful shelf life information is obtained for product kept at its intended storage temperature. Refrigerated products are stored in the refrigerator and room temperature products are stored at ambient conditions. Small changes in storage temperature may have a significant effect on shelf-life. A few degrees may determine the difference between good shelf-life and premature spoilage.

Unfortunately, in the real world, refrigerator and room temperatures are not standardized. Refrigeration can mean anything from 28°F to 55°F, and room temperature can mean 60°F to 95°F. Shelf-life at 30°F may be very different from that at 50°F, although both temperatures may represent refrigeration conditions. To have a meaningful study and in order to compare different studies, the temperatures used in the study must be known. This is most easily accomplished if the study temperatures are fixed and not varied. Temperatures of 40°F (4°C) and 75°F (24°C) are commonly used for refrigerator and room temperature storage.

In the real world, refrigeration during distribution and retail presentation storage of perishable foods, temperatures often cycle between low and high temperatures. Temperature cycling in laboratory studies of shelf-life introduces conditions which make data interpretation difficult, and temperature cycling usually is not recommended. A significantly better understanding of shelf-life can be obtained when several storage temperatures are used. For refrigerated foods, studies may be conducted at fixed temperatures in each of three ranges (38-40°F, 45-50°F, and 50-55°F). Useful room temperatures are 75°F, 85°F, and 95°F. From the information gained, inferences can often be made about other tempreatures.

Water

The amount of water in many foods determines its characteristics. Some foods are expected to be dry, some appear moist, and some obviously contain water. Water is essential for microbial growth, and if the amount of free water changes, a food's susceptibility to spoilage may change. For example, if a dry product which is resistant to spoilage becomes damp it will likely spoil. In contrast, a moist food will not spoil if it dries. Food packaging plays an essential role in the control of moisture and has a significant affect on shelf-life. There is exchange of moisture between the atmosphere and the food. The exchange continues until the food reaches equilibrium with the atmosphere.[3]

Hermetically sealed packages contain a limited amount of air, and the smaller the headspace, the quicker equilibrium is attained between food and air. For hermetically sealed samples, humidity control need not be considered as a study variable as long as the package remains intact.

Most foods are packaged to limit the rate of water exchange so that little moisture exchange occurs during the life of the product. Thus, humidity control and/or monitoring is required mainly for foods that are: 1) Subjected to temperature extremes; 2) Exposed to the atmosphere (e.g., cakes, pies, and pastries) or; 3) Packaged in air permeable containers. Relative humidities of 40,60, and 80% represent a practical range for experimentation.

Duration

The duration of the study should at least match the target shelf-life for the food. If a shelf-study of 60 days is desired for a refrigerated item stored at 40°F, the study should be designed for a minimum of 60 days. Similarly, if six months is expected at room temperature, then the study should be at least that long. The study may be designed to exceed the shelf-life goal if expectations are met and the point of spoilage needs to be determined.

If a product fails half-way through a designed shelf-life study, there is little point in continuing the analysis. On the other side, if the product is stable during one segment of a study, i.e., no microbial activity is observed, the study should be continued to the next segment. Sterile products do not require repeated testing beyond the time expected for outgrowth of any contaminating microorganisms. It is not highly unusual for microbial levels to stay constant and even decrease over a period of hours, days, or weeks before beginning to increase. This lag before growth occurs is described in more detail in a following section.

The microbiological shelf-life of a food designed to be stored at one temperature cannot be confidently determined more quickly by storing the food at a higher temperature because microbial growth is influenced by temperature. While it is true that organisms grow faster when warmer, it is not yet possible to predict the result for another incubation temperature. For rough estimation, a two-to four-fold increase in growth rate is estimated for a 18-20°F increase in temperature.

Thus, if the shelf life was found to be 10 days at 60°F, at 40°F it is estimated to be 20 to 40 days. This broad range for a prediction is not very useful. Moreover, it is entirely possible that the organisms that grew at the elevated temperature (60°F) do not grow or are not the main spoilage organism at the desired storage temperature (40° F). For these reasons, accelerated microbiological shelf-life predictions are not useful.

Methods of Analysis for Microorganisms

Microbial growth in foods for estimation of shelf-life is most commonly monitored using agar plating procedures. The procedures are quantitative for the number of viable organisms present at the time of analysis. Because of differences in growth requirements among the different types of microorganisms that may be found in food, no single procedure is available to enumerate all microorganisms. However, a simple useful procedure is the aerobic plate count which detects organisms that form colonies on plate count agar usually incubated at 35° C in 48 hours.

Many organisms are not detected using mesophilic incubation of the aerobic plate count (e.g., organisms that grow only at low or high temperatures, most lactic acid bacteria, strict anaerobes, yeast and mold). Thus, the plating procedures are usually selected on the basis of the type or types of organisms anticipated or known to be present in the food. If the "right" procedures are not selected, it is very possible to have obvious microbiological spoilage, but no experimental data to support the organoleptic observations.

Frequency of Sampling and Analysis

How often a food is analyzed for microorganisms during the shelf-life study must be decided with care in order to detect significant microbiological events. To better understand why this is important, the typical growth cycle of a population of microorganisms should be understood. The growth cycle consists of four phases (Figure 1). The beginning of the cycle is the lag phase. Increases in cell numbers are not observed during this time. In the second phase, the cell number increases exponentially: one cell becomes two, then four, and so on. In the stationary phase, neither the rate of growth nor the number of cells continues to increase. Growth stops at a density usually not exceeding 10^{10} bacterial cells or 10^{6} yeast cells per gram. The final phase of the cycle is aptly called death phase, since cell viability decreases. Another cycle will not begin until the cells are diluted into a fresh growth medium, e.g., food.

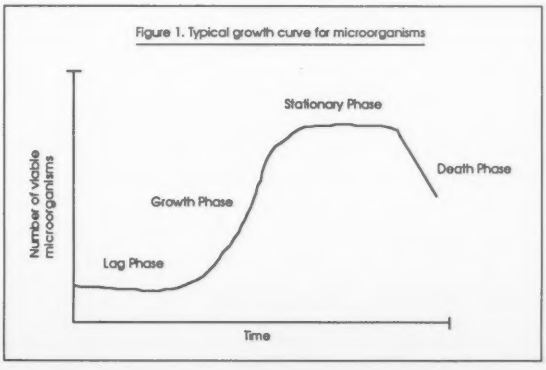

Figure 1. Typical growth curve for microorganisms

During the time the microorganisms in food are in the lag phase, the food is observed to be microbiologically stable. Once the cells enter into the growth phase and begin to multiply, the product begins to change and is considered to be unstable. At some point along the microbial growth curve, the food will usually spoil. Thus, for shelf-life, the significant points about the microbial growth cycle are: 1)The duration of the lag phase; 2)The growth rate, and; 3)The microbial count at the end of the growth phase. The end of shelf-life, 10,000,000 bacteria or 100,000 yeast per gram, usually occurs near the end of the growth phase.

To identify the different transition points along the growth path, the food is sampled periodically to quantify the number of organisms present. If the period between samplings is too long, the risk of under or over-estimating shelf-life increases. The more analyses that are completed, the more accurate will be the shelf-life determination. For most foods, the anticipated shelf-life time is divided into five to 12 intervals for sample collection and analyses. The number of intervals chosen is generally an estimation based upon experience with similar foods.

Sampling Unit and Replication

The distribution of microorganisms in a sample of food, or even between samples of food from the same production lot is not necessarily uniform. For example, if one in five bottles of food solution contains a spoilage organism, then only one of five may display evidence of spoilage. In another example, a spoilage organism present in a solid or viscous food may exhibit localized spoilage while another point without the organism is free of spoilage. Sampling plans must take into account the possible distribution of microorganisms within the lot. This is especially critical when the initial levels are lower than 10 cells per gram, which is the normal sensitivity of the agar plating procedures used for analysis. Single packages represent the most easily distinguishable analytical unit.

Fewer samples are needed to conduct a meaningful study when there is an even distribution of organisms in the product. For the homogeneous product, each analytical unit is more likely to be identical to the next. For example, liquids are homogeneous if carefully mixed each time before sampling. Each unit of liquid will represent what is in the whole. However, if the sample is not mixed, the distribution from top to bottom or side to side may not be even. In a viscous sample, thorough mixing may not be possible, so distribution of organisms may not be uniform. Any one sample may not be typical of the whole product lot. Thus for these products, multiple subsamples need to be analyzed to represent the whole. Generally, at least three carefully selected samples of a heterogeneous product are needed to obtain an acceptable representation of microbiological activity in the product.

Study Replication

A shelf-life study conducted on a single batch of food is valid for that food and any other production lot that is identical. If the microorganism type or number differs significantly among batches, the duration of the shelf-life may differ. Replication of the study will always enhance the accuracy of

the prediction. Periodic determinations of shelf-life help to provide assurance that the product remains consistent over time with respect to spoilage rate. Changes in formulation, processing, and packaging conditions call for reevaluation of shelf-life of a product.

Microbiological Challenge Study to Verify Stability

A food may exhibit an exceptionally long shelf-life even though the temperature, pH, water and nutrient levels are permissive for microbial growth. The long shelf-life may be the result of the absence of microorganisms in the samples tested or it may be due to the fact that the contaminating organisms will not grow in the particular product formulation. To understand the stability of these foods should a chance contamination event occur, a microbiological shelf-life study should be conducted where product is challenged by inoculating it with appropriate spoilage organisms.

In a challenge study, the product is inoculated with known spoilage microorganisms. The inoculated samples are then treated and stored in accordance with the shelf-life study guidelines. The addition of organisms to the foods adds several more variables to the study. The types of organisms and the number of strains of each type to be used needs to be decided. In addition, an inoculation level must be selected. The spoilage organism(s) used in the challenge study is usually one that has been isolated previously from similar foods that have spoiled. For example, *lactobacilli* and yeast are the most common spoilage organisms of salad dressing and sauces. The more isolates included in the challenge study, the greater is the confidence in the accuracy of the shelf-life assessment. In practice, five isolates of *lactobacilli*, five of yeast, and five of mold represent a reasonable selection for a salad dressing challenge study.

The number of organisms added to the food is generally significantly higher than what would normally be found as a result of contamination during processing. The inoculation levels used are generally greater than 10 per gram so that the presence of the challenge organisms can be observed easily. Ten organisms per gram is the limit of sensitivity of the agar plate count procedures normally for enumeration. Lower levels can be detected but usually at significantly greater expense and with lower accuracy.

When the level of the challenge organisms does not increase during shelf-life storage, the product formulation is resistant to microbial growth. It is stable in the sense that the number of microorganisms does not increase. However, if the organisms are present in sufficient numbers it is still possible that the metabolic activity of the nongrowing cells will cause undesirable changes in the product.

In most foods susceptible to spoilage, the organisms do not begin to multiply immediately. Instead, the count remains relatively constant for a period of time before growth is observed. The period of no growth is analogous to the lag phase of the microbial growth cycle. A fraction of the challenge organisms may be observed to die soon after being added to the test sample.

If the innoculation level was low initially and die-off occurs, it is possible to conclude, although incorrectly, that the product is stable. This is avoided by using high inoculation levels. A level of about 10,000 cells per gram is useful for observing either decreases or increases in levels even if an initial 100-fold die-off is observed.

Die-off after innoculation is most likely the result of shock caused by an abrupt change in environment for which the cells are not preconditioned. The die-off can sometimes be avoided or reduced by first adapting the organisms to the product's nutrients, acidity, or water activity. In the real world, contamination of product by both unadapted and adapted organisms occurs. Organisms originating in the environment and entering the food through contact are simulated by use of organisms that are not specifically adapted for growth in the product. Adaptation simulates product to product contamination.

Microbiological Challenge to Determine Food Safety

Challenge studies using pathogens are conducted to measure the behavior of those microorganisms in foods and formats similar to studies with spoilage microorganisms are used. The purpose of using pathogens is to measure their growth, inhibition, or die-off in a food. Commonly used pathogens are *Salmonella*, *Listeria monocytogenes*, *Staphylococcus aureus*, *Bacillus cereus*, *Clostridium perfringens*, *Yersinia enterocolitica*, *Clostridium botulinum*, and *Escherichia coli*. If the pathogens do not grow, the food is considered stable with respect to the ability of the food system to inhibit their growth.

The duration of the lag phase of the pathogens will be influenced by inhibiting changes in the organism's environment. The greater the inhibition, the longer the lag phase. Even shifts in incubation temperature between that used to propagate the organism for the study and the storage temperature of the product may change the length of the lag period. Therefore, the conditions used to prepare the organisms must be carefully chosen to account for the specific needs of the study.

Mathematical Modeling of Microbial Growth in Foods

The influences of atmosphere, temperature, water, pH, preservative, and nutrients on the growth of microorganisms are easily measured. If enough data are collected, derivation of a mathematical equation of growth is possible and could allow a quick estimation of shelf-life by plugging the required variables for the food into the equation. Mathematical models which include some of the growth controlling variables for bacterial pathogens are available.[4,5,6] The models are interesting, but not necessarily accurate when applied to foods. They are useful for playing "what if" games, such as: "How much longer is the growth of *Salmonella* delayed by decreasing the pH of the food from 5.6 to 5.4?" Future refinements will most certainly make models more useful. However, it will be a long time before they can reliably replace experimental shelf-life studies.

Accurate prediction of shelf-life necessitates a carefully planned and executed series of experimental studies. Shelf-life should be reevaluated in the event ingredient, formulation, processing, packaging or storage changes are anticipated. The knowledge gained from these studies promotes reliably confidence that the product delivered to the customer is safe and of high quality.

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The Yogurt Story - Past, Present and Future Part IV

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Introduction

It is difficult to provide a universal make-procedure for yogurt to suit every variation in the final product marketed by the industry. Also, it is impossible to prescribe universal fermentation conditions because dairy plant schedules and turn-over times required for incubation vats and other accessory equipment differ from one operation to another. Whatever procedure is used, it is essential that the final product conforms to the requirements of the Code of Federal Regulations and State Regulations, is safe for public consumption, has a satisfactory shelf-life and meets consumer demands with respect to body, texture and flavor characteristics. In this paper, only general principles involved in yogurt manufacture will be discussed. Manufacture of yogurt consists of five major steps, namely:

1. Preparation of yogurt mix - ingredients, mixing, homogenization and heat treatment.
2. Setting - temperature of setting, addition of starter.
3. Fermentation.
4. Breaking and cooling - pH at breaking, cooling procedures.
5. Addition of fruits etc., and filling.

Preparation of Yogurt Mix

A. Ingredients: Quality of the ingredients used decides the quality of the final product. All the ingredients used should be of the highest quality. It is important to institute quality control procedures for all the incoming raw materials with respect to appearance, solubility, freedom from extraneous matter, chemical identity and bacteriological content. For dairy ingredients, tests for antibiotics and other inhibitors should also be included. Warehousing ingredients properly - protecting from moisture, insects, and rodents - is also very important.

Dr. Frank Kosikowski in his book *Cheese and Fermented Milk Foods* (5) notes the following: "Modern cultured yogurt manufacture is associated with a high degree of mechanization, but its center point is the unique bacterial fermentation. Although whole milk is often the only dairy ingredient required, skim milk, condensed milk and dried skim milk may be blended and homogenized to give low fat and high total solids content. These blends may be increased in total solids to 15 to 17 percent by fortifying with two to three percent spray dry skim powder or evaporating them in a vacuum pan or vacreator. Ultrafiltration and reverse osmosis also may be used."

Chandan (l) states: "Yogurt is generally made from a mix standardized from whole, partially defatted milk, condensed skim milk, cream and nonfat dry milk. Alternatively, milk may be partly concentrated by removal of 15 - 20% water in a vacuum pan. Supplementation of milk solids-not-fat with nonfat dry milk is the preferred industrial procedure."

The most commonly used sweetener in yogurt is table sugar or sucrose. Sucrose may be used in crystalline form or as a concentrated syrup. Corn sugar (dextrose) and, in some cases, honey and high fructose corn syrup are also used. For dietary yogurts, non-nutritive sweeteners like saccharin, asparteme etc., may be used. A note of caution in the use of artificial sweeteners is necessary. Non-nutritive sweeteners or combinations thereof may deleteriously interact with other components in yogurt to cause off-flavors or bitter flavors. Careful experimental work is necessary to develop a suitable non-nutritive sweetener system for each different category of flavored yogurt. For further details on the effect of various sweeteners or combination of sweeteners on the quality of yogurt, the reader should consult articles by Hyvonen and Slotte (3), McGregor and White (6), and Keating and White (4). The level of sweeteners used depends upon the type of yogurt and the concentration of sugar(s) and/or sweeteners available in fruit purees and preserves.

Stabilizers are used to produce a thick, cohesive body, smooth texture and to prevent wheying-off. Use of stabilizers also insures a uniform product with respect to body and texture from batch to batch. Problems related to stabilizer usage are usually attributable to under-stablization or over-stabilization and improper use of stabilizers. Under-stabilization results in a weak body and separation of whey. Over-stabilization on the other hand, produces a slick, rubbery or "jello-like" springy body. Improper usage consists of appli-

cation of wrong combination of stabilizers and lack of care in dissolving stabilizers. Too fast addition of stabilizer or adding stabilizer at improper temperature may cause lumping. Adding stabilizer to too hot a mix will cause "case - hardening" or the formation of a thick, leathery pellicle over stabilizer granules, which do not dissolve or hydrate. This results in a grainy texture in the finished product. Each batch of stabilizer should be tested in laboratory or pilot plant before using on a commercial scale. For these trials, it is best to use the supplier's recommendations as a starting point and make suitable adjustments.

Stabilizers commonly used in yogurt and their properties are summarized in Table 1. For a more detailed discussion of gums used as stabilizers, a recent paper by Dziezak (2) should be consulted.

Table 1. Stabilizers Commonly Used in Yogurt

Stabilizer	Source	Advantages/Disadvantages
Gelatin	Hydrolysis of meat proteins collagen and ossein.	Good stabilizer for yogurt and frozen yogurt. Gives a smooth product. Dissolves well between 55°C and 65°C. Degrades at high temperatures. Not compatible for Kosher status.
Alginates	Sea weeds	Gives a smooth product. Heat stable. Complex with calcium and casein to give a good gel. Dissolves at room temperature.
Carrageenan	Sea weeds	Similar gelling mechanism as alginates. Dissolves between 50°C and 80°C.
Carbo gum	Seeds of a legume	Effective at low pH.
Guar gum	Seeds	Good stabilizer. Stable at high temperature. Soluble in the cold.
Starch	Cereals	Good in combinations.
Carboxymethyl cellulose	Cellulose	Effective for high temperature processing.

B. Mixing and homogenization: Depending upon the category of yogurt manufactured - ie., regular yogurt, low fat yogurt or non-fat yogurt - fresh milk is standardized with respect to milkfat. To obtain a thick, spoonable, custard-like body, fortification with 1 - 2% Grade A nonfat dry milk is necessary. Skim milk powder is added after the standardized milk is warmed up to about 100°F with agitation to aid dissolution of the powder. Following this, if stabilizer is needed, it is added (usually about 0.2 - 0.3%) along with cane sugar (depending on the type of yogurt made will vary from 4 -10%; plain yogurt may not need any sugar) through a powder horn into the warm milk with constant agitation.

The fortified milk is further warmed up to 145°F and the mix is homogenized at 3000 psi single stage. Homogenization is a very important step. Homogenization breaks fat globules of varying sizes normally occurring in milk into small, uniformly-sized and evenly distributed particles. Homogenization prevents fat separation. Additionally, homogenization of mix aids in the dissolution and uniform distribution of powdered ingredients by breaking up any residual granules or grains. The end result is a smooth, creamy, rich product. Single stage homogenization promotes apparent thickness.

C. Heat - treatment: After homogenization, the mix is transferred to a double-walled stainless steel vat designed for pressurized heating. The mix is further heated to 180° F and held at that temperature for 30 min. Yogurt mix contains high level of milk solids and other solids like sugars, stabilizer etc., which afford good protection to native microorganisms in the mix during heating. So, yogurt mixes like ice-cream mixes, need a higher temperature of pasteurization. Such relatively high heat-treatment of yogurt mix accomplishes the following:

1. Destroys unwanted pathogenic and spoilage microorganisms, natural enzymes and heat labile inhibitors in the raw ingredient mix. Destruction of native microflora eliminates the biological competition for starter bacteria and renders the contents of the vat safe for public consumption.
2. Heat-treatment creates reduced (low oxidation-reduction potential) conditions in the mix and liberates certain stimulatory compounds which promote the growth of yogurt starter bacteria.
3. Heat-treatment at temperatures ranging from 180°- 190° F for 30 min. that is usually used for yogurt mixes results in the interaction of whey proteins with k-casein to form a complex. When casein precipitates (forms a coagulum) as the pH falls down to 4.6 (isoelectric point of casein), the complexed whey protein also coagulates. This results in a thicker, heavier body in the yogurt.

During heat treatment, it is important that the come-up time to 180° - 190°F is quick and, after holding, the time to cool to the set temperature is also rapid. Otherwise excessive heating of the mix occurs. This could also happen if temperatures above 190° F are used. Such over heating results in excessive denaturation of native casein that the coagulum has weak, soft body and tendency towards wheying-off. Fairly rapid and even agitation of the mix during heating, holding and cooling down to set temperature will avoid excessive heating of the mix.

Setting

Setting is the term used for procedures involved in preparing the mix for the starter followed by the addition and uniform mixing of the starter into the mix and adjustment of conditions for the actual fermentation of the mix.

Setting involves the following:

a. Adjustment of the mix temperature to the desired point at which the starter can be added. This depends upon the rapidity of fermentation desired. Usually the set temperature will range from a low of 95° F to high of 115° F. Higher temperatures are used for a rapid turnover and lower temperatures for a longer fermentation period. To obtain a heavier body using capsule-produc-

Cont. on p. 374

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ing yogurt strains, usually lower temperatures are preferred. An intermediate range of 105° - 110° F generally gives a uniformly smooth body.

b. After adjusting the temperature to the desired point, the starter is added. Bulk starter or concentrated direct-vat-set starter may be used. Bulk starter made in skim milk is usually added at rates ranging from 2 1/2 - 5% to obtain a 4hr. set time. The starter should be mixed in uniformly. This is especially important with frozen direct-vat-set cultures. Over-agitation should be avoided to prevent excessive air incorporation.

c. Once the starter is mixed in, agitation should be stopped and the temperature control set at the desired point and the fermentation should be allowed to proceed in quiescent state.

Fermentation

Fermentation as applied to yogurt is that phase in its manufacture during which the microorganisms added in the form of starter to the prepared mix, convert part of the lactose or other sugars in the mix to lactic acid and trace metabolites (acetaldehyde, acetic acid, propionic acid, formic acid, diacetyl, etc.) and transform the mix to an acid coagulum which has a tart, typical green acetaldehyde flavor. Fermentation then, is the heart of yogurt manufacture. So it is necessary that conditions are held to favor the desired fermentation. These include good temperature control, careful monitoring of pH and undisturbed incubation. At higher incubation temperatures, because of rapid fermentation, careful monitoring of pH is necessary.

Breaking and Cooling

Once the desired pH is reached (usually between 4.3 - 4.5), the fermentation should be arrested to prevent excessive acid accumulation. This is achieved by processes that would allow rapid cooling of the curd mass. To obtain heat transfer through the curd mass, the coagulum is broken by turning on the agitator first at low speed and then at a slightly faster rate concomitant with the circulation of "sweet water" through the vat jacket. The design of the agitator and the rate of mixing should be carefully selected to cause minimum damage to the curd matrix.

The pH at breaking would depend upon the size of the fermentation vat and the rate at which the product could be cooled to <45°F. If a long time is needed to cool down the product, the pH at breaking should be higher. The same would apply if the product has to be held for any length of time before filling.

In the industry, large batches of yogurt are speed-cooled by using cone-vats, specially built plate-coolers or by counter-current flow through concentric tubes down to about 80° F, and further chilled to <45°F. in the vat. If the product could be filled without much delay after breaking, European processors commence the filling operations when the yogurt is cooled down to 70° - 75° F. According to some European processors, the curd structure appears to undergo minimum damage when handled between 70° - 75° F, and firmness is regained when the filled cartons are chilled in the cooler to <45° F.

Flavor may be added, if needed during cooling. This is done for flavored yogurt without fruit like vanilla and also for Swiss style yogurt.

Adding Fruit and Filling

Post-fermentation operations beyond cooling are the most critical steps in insuring the overall quality and shelf-life of the product. Fermentation occurs after heat treatment of mix in a closed system and hence, the product is protected from external contamination. During cooling unless the product is unduly agitated or abused, the body and the protein matrix of the coagulum is retained. In most instances, loss of body and weakening of the coagulum happens during the transfer of the product from the fermentation tank to the filler. To retain the body and integrity of the coagulum, a positive pump should be used for moving the product. An alternative would be to use air pressure to evacuate the tank. Pumping through long lines or through a series of elbows or through constrictions in the line because of variations in the internal diameter of the piping or using a centrifugal pump instead of a positive pump or air evacuation destroys body and curd integrity. In certain operations an in-line screen is used to smooth out any lumps; in such cases proper stabilization of the mix is essential.

Fruit may be distributed in the body of the yogurt through an in-line fruit-feeder or may be mixed in, in a blending tank. For fruit-in-the bottom or fruit-on-the top Sundae style yogurt, metered portions of the fruit are added at filling ports situated before or after the main fillers. Pneumatic or gravity fillers are recommended for yogurt.

The lines from the fermentation vat to the filler, the pump, accessory equipment used in fruit incorporation and filler are the major sources of contamination of the product. So special care should be taken to thoroughly clean and sanitize these parts. The filling area should be protected from air drafts and unnecessary traffic.

After filling, the containers should be transferred to a walk-in cooler with good air circulation. The product should be held in the cooler for at least a day for proper "knitting" and gelling to develop the desired body, texture and mouth-feel.

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News

C. Dee Clingman

IAMFES Secretary Winner

Dee Clingman through vote of the IAMFES membership will begin his term on the IAMFES Executive Board in July, 1991.

Dee Clingman is Vice President of Quality Control for General Mills Restaurants, better known as Red Lobster and The Olive Garden restaurants. In this capacity he directs a 36 person department providing quality direction and food protection to over 800 restaurants in the United States and Canada.

Dee began his public health career over 20 years ago as a sanitarian in the Warren County Health Department in Ohio where he was responsible for all environmental health programs. He then directed the foodservice manager sanitation training and certification program for the Ohio Department of Health, where he developed and implemented the nation's first pioneer program on such training and certification. Dee later went to the Chicago area as Director of Food Protection for the National Institute for the Foodservice Industry. There he developed and implemented a national uniform foodservice manager training and certification program under contract for the Food and Drug Administration. In 1979 he joined Red Lobster as Director of Quality Control and rose to his current position for General Mills Restaurants.

Dee holds a master of science degree in Environmental Health Engineering from the University of Cincinnati and a bachelors degree in Biology and Psychology from Bowling Green State University. He is a Registered Sanitarian in Ohio as well as in two other states.

Throughout his career, Dee has been an innovator, a strategist, and a pioneer in new environmental health programs. Dee is the proud recipient of the IAMFES Harold Barnum Industry Award (1983) for most outstanding service to the public, IAMFES, and the profession of the Sanitarian. He was also presented the Food Industry Sanitarian Award by the National Environmental Health Association in 1985 for his contributions to environmental sanitation in the food industry.

Dee has been elected or selected to participate in numerous national committees or task forces in the food protection area. He has made numerous public speaking engagements at state and national public health and industry organizations. He has been recognized by foodservice leaders and in industry publications for his accomplishments in advancing foodservice food protection.

Dee has been active in IAMFES for many years, serving on the Editorial Board of the *Journal of Food Protection* and *Dairy, Food and Environmental Sanitation*. He was Chairman of the Journal Foodservice Committee (1978-82). Dee has presented numerous papers at IAMFES annual meetings and has published articles in the *Journal of Food Protection* and *Dairy, Food and Environmental Sanitation*. He was the initiator of the IAMFES Norbert F. Sherman Award. Earlier in Dee's career he was elected Treasurer of the Ohio Environmental Health Association for two terms.

Dee is 43 years old and has been married to his wife Joanne for 19 years. They have two sons and a daughter and live in Orlando, Florida.

A.D.P.I. Announces Award of Merit

The American Dairy Products Institute announces the establishment of an Award of Merit to recognize individuals who have made outstanding contributions to the processed dairy products industry. The first Award of Merit recipient is expected to be recognized at the 1992 Annual Meeting of the American Dairy Products Institute, to be held at the O'Hare Marriott Hotel, Chicago, Illinois, on April 27-30.

Persons wishing to submit the names of individuals to be considered to receive the American Dairy Products Institute's Award of Merit may submit the candidate's name in a brief letter of nomination to either Dr. Warren S. Clark, Jr., Executive Director, American Dairy Products Institute, 130 N. Franklin St., Chicago, IL 60606, or Mr. Gerald J. Treleven, Trycon Associates, Inc., 3958 Cambridge Road, Suite 111, Cameron Park, CA 95682.

ADPI is the national trade association of the processed dairy products industry. It was formed in 1986 through a merger of the American Dry Milk Institute and the Whey Products Institute; in 1987, the Evaporated Milk Association merged with the ADPI. Headquartered in Chicago, IL, the Institute represents producers of evaporated and dry milk products as well as whey and whey products, including lactose.

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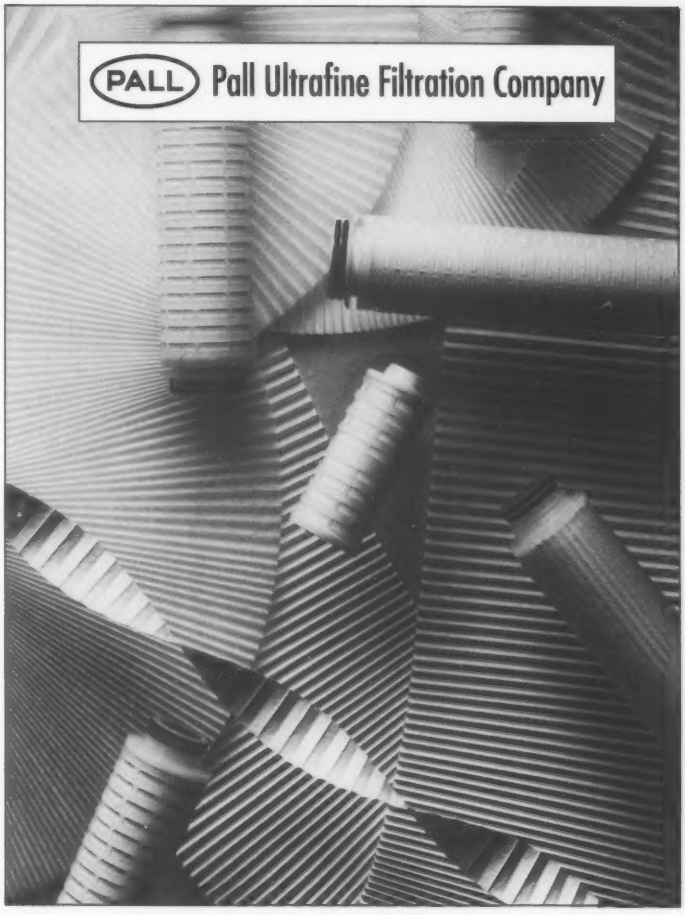

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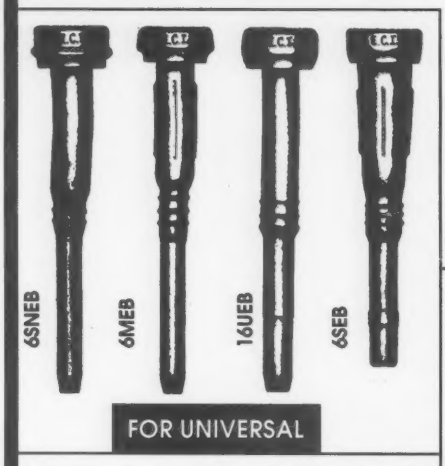

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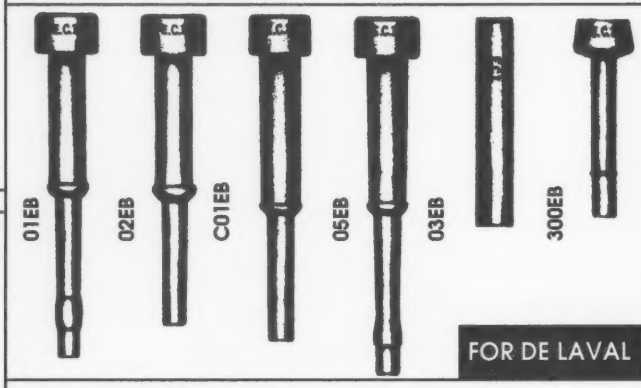

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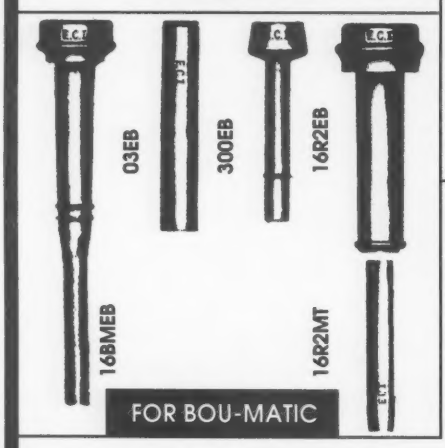

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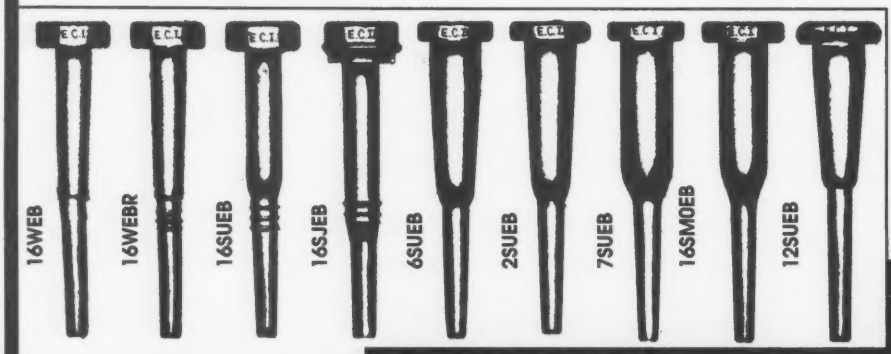

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University of Minnesota Plans Dairy Study Tour to Kentucky

The University of Minnesota is planning a tour for this summer that will focus on dairy farms and other points of interest in the Lexington, KY area.

The annual Dairy Study Tour will be July 30-Aug. 6. It is for dairy producers, DHI technicians, extension educators and others in the dairy industry. The tour is sponsored by the Minnesota Extension Service and Department of Animal Science.

The tour will focus on 10 of the most modern dairy operations in the bluegrass area that includes Lexington, Frankfort, Paris, Louisville and Bardstown. Feeding, breeding, housing, herd improvement, herd health, calf raising, management and marketing dairy products will be topics of attention.

The tour group will visit other agricultural enterprises also, and there will be stops at the Kentucky Horse Park, Shaker Village, Makers Mark distillery and historic points of interest.

Qualifying farm operators may use the tour as a tax deduction. For more details and a tour brochure, contact Extension Special Programs, 405 Coffey Hall, University of Minnesota, St. Paul, MN 55108-1030; phone (800) 367-5363 or (612) 625-1978.

ADSA Announces Dairy Foods Research Program for 1991 Annual Meeting in Utah

Specialists who form a broad spectrum of scientific expertise in dairy food research will gather for the Annual Meeting of the American Dairy Science Association (ADSA) in Logan, Utah, August 12-15, 1991.

"Dairy product development research activities are at an all-time high," notes Doug Willrett, chairman of the food division program committee for the ADSA Annual Meeting. "These sessions provide product developers an in-depth look at the state-of-the-art in dairy technology and research," says Willrett, who heads R & D for Marschall Products, Madison, Wisconsin.

Symposia on the food division program include "New Advances in the Thermal Processing of Milk;" "Science and Technology Advance: How Can Education Keep Pace?" "Recent Developments in Dairy Starter Cultures: Microbiology and Physiology;" "Frozen Dairy Desserts: A New Age;" and the Borden symposium, "Effect of New Milk Protein Determination Technologies on the Dairy Industry: Crude vs. True Protein." In addition, the Marschall-Rhône Poulenc International Award Lecture will provide an enlightening international perspective on dairy research.

ADSA's Annual Meeting is traditionally geared toward ready exchange of scientific information between researcher and industry. "There's every opportunity to meet one-on-one with researchers developing tomorrow's technology. The meeting draws on several disciplines in dairy science from all parts of North America," notes Willrett.

Graduate students will present posters and talks at the ADSA meeting, offering managers and administrators from industry and academia the opportunity to interview and observe research performance at the graduate level. A Graduate Student Paper Contest adds a competitive challenge to the graduate sessions.

ADSA will hold its Annual Meeting on the campus of Utah State University in Logan, and attendees are invited to bring their families for concurrent family events.

To receive more information and registration materials for the August 12-15 meeting, contact the ADSA office at 309 W. Clark Street, Champaign, Illinois 61820; or call (217) 356-3182 or FAX (217) 398-4119.

New Zealand Company Set to Increase Biochemical Exports in North America

Increased international sales of specialized biochemical products made in New Zealand has resulted from the recent expansion of Immuno-Chemical Products Ltd (ICP), based in Auckland, New Zealand.

Used in specialized fields of quality control testing in the dairy industry, pharmaceutical supplements and embryo transplants in dairy cattle and buffalo, the products are meeting a growing demand for high quality products.

They are sold in nearly 30 countries including the USA, the UK, Canada, France, Germany, Australia, India, the Scandinavian countries, Israel, The Netherlands, Kenya, Malaysia, Japan, Spain, Saudi Arabia and a recent inquiry has been fielded from Bulgaria.

Formed in 1983, the company now exports over 75% of its production and the new 750 square meter complex is geared for even greater growth. Over 25 product categories are included in the range.

ICP's founding directors, Dr. Rosemary Sharpin and Maxine Simmons report that all products are derived from waste products in New Zealand's large freezing (meat) industry. Refined biochemicals are extracted from glands, blood and brains and converted into high value, specialized products.

The company's success is attributed to the high quality raw materials available in New Zealand and the clean, disease free environment which prevails there.

Of major significance to the world dairy industry is the revolutionary new product Mastest, an accurate testing procedure for detecting mastitis in cows. The new technology was developed entirely by ICP personnel and is fast being adopted by New Zealand dairy companies and testing laboratories.

Its use allows milk quality to be maintained and it provides an early warning detection of the disease for dairy farmers.

Another product, RCT, is a highly sensitive, but simple and rapid test for detecting coliforms (bacterial contamination) during processing of milk. Its use ensures any

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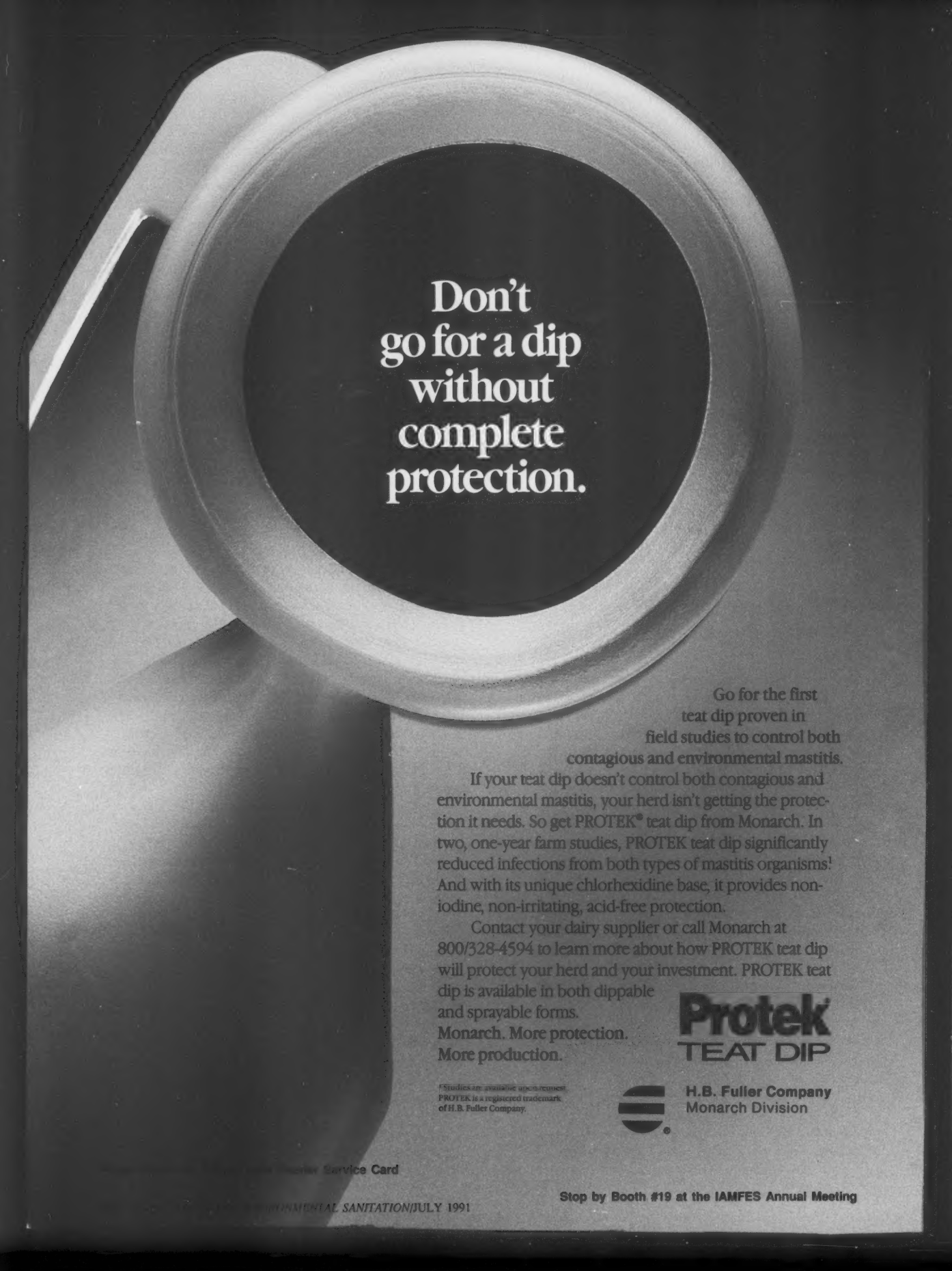

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contamination can be detected before it is revealed as costly down-graded finished products.

The United Nations approved product, Bovtest, was developed by ICP for detecting the presence of both goat and/or sheep milk in cows milk. Its use is of major value in determining the true nature of the milk supply, particularly when supply is made under quota.

An established seller internationally is Ovagen ™, an animal hormone which is used in embryo transplant programs to induce female animals to become "super ovulators" and hence speed up the gain of favorable genetic characteristics.

Ovagen was developed in 1985 as a joint venture between New Zealand's Ministry of Agriculture and Fisheries Technology division and ICP. Derived from the pituitary glands of sheep, the product is used in a wide range of species including sheep, cattle, goats, deer and buffalo.

Even endangered species, such as the white rhino are benefiting from the product in Kenya. It is also used to speed up the genetic gain in fighting bulls in Spain and to increase the pace of racing camels in Saudi Arabia.

Laboratory Waste Disposal: New AOAC Short Course

AOAC has developed a new short course on "Laboratory Waste Disposal and Environmental Compliance" in response to OSHA-promulgated regulations requiring that laboratories prepare and implement a Chemical Hygiene Plan. This legal requirement became effective January 31, 1991, and under the terms of the plan, laboratories must develop and implement the following procedures:

- Standard Operating Procedures
- Criteria for implementation of control measures
- Measures to ensure performance of fume hoods and other protective equipment
- Employee information and training
- Circumstances under which particular operations require prior approval
- Provisions for medical examinations
- Designation of a Chemical Hygiene Officer
- Provision for work with particularly hazardous substances

Because of these demanding new requirements, the Chemical Hygiene Plan is more than just a series of "safety procedures," according to course co-director Kenneth Fischer, senior scientist and head of the Environmental Hygiene group with Dames and Moore in Bethesda, MD, a private environmental consulting firm. By attending this short course, scientists will become aware of the major provisions of this regulation and be given examples and materials that will assist them in preparing their own Chemical Hygiene Plans for their respective laboratories, as required by law.

Environment Demands Attention

"Anything related to the environment these days demands attention," says Fischer. Laboratories are becoming more concerned about hazardous waste disposal because of disasters such as the one that shocked beach goers in New Jersey a few summers ago when medical waste washed onshore. Also, the U.S. Justice Department has increased criminal enforcement actions against indiscriminate hazardous waste disposal practices, including indictments returned against laboratories.

"A cradle-to-grave liability exists for hazardous waste," says Fischer. "If for some reason a laboratory's waste material surfaces some time in the future at a superfund location, the laboratory itself could be required to pay cleanup costs because the laboratory retains ultimate responsibility for the materials."

Prior to legislation dictating proper waste disposal, many laboratories did not dispose of their waste properly. "Material was poured down the drain or disposed of in dumpsters," says Fischer, "...since then, people have become more environmentally responsible and aware of increasing waste disposal regulations."

Laboratories are monitored for environmental compliance primarily by EPA. Fischer, who previously worked in EPA's criminal enforcement division, says EPA too has intensified its civil and criminal hazardous waste enforcement efforts. Although laboratories are generally regarded as "small fry," a complaint or a mishap, such as an explosion, could trigger an inspection. "Aside from the enforcement issue, however, most laboratory personnel sincerely wish to do the right thing with their wastes," says Fisher, "but have difficulty in understanding and applying the regulations."

Four Different Course Locations

The course, which will be co-directed by Jerry Bucklin, director of Environmental and Waste Management Services for Network Environmental Systems, Inc., will be held on four different occasions in 1991 in Toronto, Phoenix, San Diego, and Durham. Each short course will run 16 hours. The course outline includes basic toxicology, laboratory hygiene, regulatory compliance, and related topics such as hazard communication.

Hazard communication is important because laboratories often mistakenly assume that their employees know about the hazards of the chemicals they handle. "Laboratory personnel," says Fischer, "are better informed than the general public on chemical hazards, but at the same time, there can be some harmful gaps in their knowledge...We're speaking of thousands of chemicals...we can't expect chemists to know the hazards of all of them."

Part of the procedures for disposal that Fischer will discuss includes taking preventive measures. "Generally, laboratories should first minimize their use of the materials and reuse as many of them as they possibly can...and substitute chemicals of lower toxicity to perform a particular analytical procedure...it begins with the very purchase of the materials."

Although most laboratories choose to work with a handler or broker for the disposal of their hazardous wastes,

Fischer urges laboratories to exert close oversight over the contractor because laboratories are ultimately responsible for their wastes and must sign the hazardous waste manifest required by authorities.

Fischer anticipates that most of the short course participants will already have some experience for overseeing waste disposal in their laboratories. Participants will be given a resource manual containing a variety of background and explanatory information pertaining to the lectures.

Short courses save the often overworked laboratory scientist from having to sift through and make sense of the voluminous information by presenting the material in a more condensed and digestible format. In lieu of the short course, says Fischer, individuals would need to undergo "an intensive program of self study."

The knowledge gained will be invaluable and may keep a laboratory from being fined. Fischer believes that when participants leave the short course, "They will be able to avoid some common pitfalls in handling their waste materials that otherwise could result in regulatory problems, and negative inspections, among other things. They will gain information that will assist in lowering the costs of their waste disposal operations...and they'll also be aware of the related safety issues and OSHA requirements, as well as EPA regulations."

Sparta Brush Promotes Dunn

Jack Larson, President and Chief Operating Officer of Sparta Brush Company, has announced the promotion of Jim Dunn to Executive Vice President of Sales and Marketing.

Dunn adds the sales responsibilities to market research and planning, new product development, account promotions and trade shows. He joined Sparta in 1990 after five years with Lincoln/Wearever.

Also included in Sparta's management team are: Joe Larson, Chairman of the Board, Jack Horner, Vice President of Sales and Administration, and Milan Peters, Vice President of National Accounts.

Sparta Brush Company is a leading manufacturer of high quality specialized brushes for the food service, dairy, food processing, janitor supply and gourmet industries.

AFFI Fliles Comments With Department of Transportation on Proposed Backhaul Regulations

In comments to the Department of Transportation (DOT), the American Frozen Food Institute (AFFI) provided an industry perspective on proposed rulemaking intended to protect food from contamination during transporting.

The comments, which were filed April 29, 1991 with DOT's Research and Special Programs Administration, were in response to an Advance Notice of Proposed Rulemaking (ANPR) released in February.

"AFFI has been involved with the backhaul issue from the beginning," says Steven C. Anderson, AFFI president. "Last year our efforts were successful in helping to pass legislation in Congress that not only supported the interests of our membership, but also ensured the safety of our food supply. Now we are sending the message to the Department of Transportation in hopes that fair, safe regulations will be the outcome."

In AFFI's remarks, Anderson offered suggestions on how DOT could enforce compliance of regulations under the Sanitary Food Transportation Act (SFTA) in an equitable manner.

As for recordkeeping and verification procedures, AFFI stated that food processors should be allowed to rely on certification or guarantees from their suppliers that vehicles are suitable and safe for transportation of food products.

In addition to existing regulations, "certain voluntary industry measures have been developed and are currently standard practice for many parties in the food transportation industry," said Anderson.

He referred to AFFI's testimony at a Senate subcommittee hearing where a representative of a member company said her company submits written instructions to motor carriers. "These instructions specify that no vehicle which previously hauled solid waste or hazardous materials may be delivered for loading," he continued.

Anderson further stressed the need for manufacturers and distributors to rely heavily on those providing vehicles to take responsibility for safe transportation of food. He said food processors "cannot be expected to continuously monitor the use of the vehicles furnished to them by the carriers."

"AFFI strongly supports a certification procedure whereby any person providing a motor vehicle for use in the transportation of food products would be required to provide a written certification or guarantee to the shipper, receiver or other person using the vehicle," stated Anderson. "The certification should state that the vehicle has not been used to transport prohibited nonfood products, or if it has, that the vehicle has been properly decontaminated."

AFFI believes that a manufacturer or distributor could provide a written notification to a carrier stating whether freight is a food product, acceptable food product, or an unacceptable nonfood product. This method, said Anderson, not only would provide notice to the carrier but would minimize the need for additional paperwork or forms.

As for financial responsibility, AFFI supports a system of self-insurance. "The level of financial responsiblity will vary dramatically depending on the type of product being hauled and the end use for the product," added Anderson, "therefore it would be difficult to establish a single minimum level of financial responsibility."

Another important issue addressed in AFFI's comments concerns a list of acceptable "nonfood" products which would not be subject to the regulations. Anderson cited a report by the House of Representatives Public Works and Transportation Committee that identifies these products as "materials which are clearly not solid waste,

Cont. on p. 384

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such as pallets, truck cleaning products, out-of-date foods, dented cans, or other distressed food products."

The committee also includes cardboard and food packaging on the list of solid waste items which may be hauled in refrigerated trucks as long as DOT determines they pose no risk to food safety. A Senate committee report follows along the same lines as the House report.

To the extent that the House and Senate reports are applicable to transportation in vehicles covered by this section of the legislation, wrote Anderson, AFFI supports a list that would include those products or categories of products identified in these reports.

Anderson further suggested that DOT consider including additional products that "clearly would not make food products unsafe to the health of humans or animals."

Other positions taken by AFFI include support of a method of distinguishing products that takes into consideration the difficulty of cleaning, decontaminating and sanitizing vehicles; support of a "graduated" system of cleaning and decontamination procedures depending on the type and extent of contamination involved; and support of a policy that would allow transportation of different nonfood products in the same vehicles, and rejection of legislation intended to prohibit such practices.

"AFFI looks forward to continued participation in this effort to develop an effective and efficient implementation of the requirements of SFTA," concluded Anderson.

AFFI is the national nonprofit trade association that has represented the interests of the frozen food industry for 50 years.

Use of Computers on Public Health Controls of Grade 'A' Pasteurizers

On July 18, 1986, the Milk Safety Branch issued M-I-86-12 which addressed the use of computers or programmable controllers in Grade 'A' dairy plants. That memorandum essentially required all public health controls to be hardwired. Since that time, there has been considerable interest in the use of computers and programmable controllers. This memorandum is intended to replace M-I-86-12.

The Milk Safety Branch in cooperation with FDA's Food Engineering Branch have developed the "CRITERIA FOR THE EVALUATION OF COMPUTERIZED SYSTEMS FOR GRADE 'A' PUBLIC HEALTH CONTROLS." This document contains: background information, a glossary of terms, logic diagrams and specific criteria for evaluating computer operations. FDA will use these criteria when reviewing any Grade 'A' systems which utilize computers to control public health controls (time, temperature or pressure) as to compliance with Item 16p of the Grade 'A' Pasteurized Milk Ordinance. It is suggested that state regulatory agencies utilize these "criteria" when reviewing and approving any changes to existing or newly installed pasteurization systems which incorporate computers or programmable controllers for public health controls. Equipment designers, manufacturers and installation personnel should use them to provide uniformity and compatibility of inter-related components within a pasteurizing system.

Because of the number of proposals and limited resources, FDA will be unable to review all submitted proposals for computer or programmable controller systems. FDA will attempt to review those submitted proposals which involve flow diversion devices, recorder controllers and booster pump pressure controls. This "criteria" will assist state agencies in making determinations as to compliance with the Pasteurized Milk Ordinance.

Copies of this memorandum are available for distribution to Regional Milk Specialists, state milk sanitation regulatory agencies and State Milk Sanitation Rating Officers in your region/district. Copies of this memorandum should also be made available to respond to requests from industry representatives. Contact Jerome Kozak, Milk Safety Branch, 200 C Street, SW, Washington, DC 20204.

Lytle Named to Head New Land O'Lakes Business

Land O'Lakes announced the appointment of Peter Lytle to the position of General Manager of Advanced Food Sciences, Inc. (A.F.S.), a wholly owned subsidiary of the Twin Cities-based food and agriculture cooperative. Lytle also will continue to manage the contract research programs of R-TECH, a business unit of Land O'Lakes.

The first business to become operational under the A.F.S. banner will be The Center for OHMIC Commercialization. This is a new and highly effective aseptic food processing technology which uses electrical current to sterilize fluids and particulates. A pilot facility to research and process products using this new technology will be set up at Land O'Lakes. It is planned to partner the development of this process, which has already been comercialized in the United Kingdom, with a limited number of interested parties.

Lytle is a graduate of the University of Northern Iowa and the University of Iowa and has been on the Land O'Lakes staff five years. He has held previous product development positions at Land O'Lakes and prior to that he was vice president of marketing with Allied International and a group marketing manager with Beatrice. Land O'Lakes is an agricultural supply, dairy processing and food marketing cooperative. It is owned by individual dairy producers and 1,200 local cooperatives serving more than 300,000 farmers and ranchers in a 15-state region. It markets more than 600 food products in the United States. In 1990 it ranked 188 on Fortune magazine's listing of the nation's 500 largest corporations.

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New Approaches in Prevention Of Pathogen Colonization In The Intestinal Tract Of Food Animals

The key to controlling microbial contamination of raw poultry or meat including *Salmonella* and *Campylobacter* organisms is the prevention of high level contamination in the gut of live animals.

At present, at least 3 interventions appear to have some practical merit and are likely to be cost-effective in reducing microbial contamination of food of animal origin. They are: 1) competitive exclusion (Nurmi concept); 2) addition of various organic acid compounds to processed animal feed to prevent growth of pathogens in the feed during storage; 3) adding various carbohydrates (sugars) to animal diets in either their water or feed.

1) The Nurmi concept establishes an adult gut flora in newly-hatched chicks or poults. Treatment of newly-hatched birds with an aerobic culture of intestinal material from adult *Salmonella*-free birds makes them resistant to infectious doses of *Salmonella*. This work has been repeated throughout the world. The most extensive experience as to the effect of the method on *Salmonella* is to be found in Finland and Sweden. It was established that the competitive exclusion method has effectively decreased the number of infected flocks.
2) Various combinations of organic acids have proven to be effective when added to manufactured feeds in the prevention of contamination or recontamination by certain pathogens, especially *Salmonella*. Some of the organic acids also seem to have the added ability to prevent colonization of *Salmonella* in the intestinal tract of animals. Without adversely affecting the live animals, these acids can alter the intestinal microbial flora and significantly reduce contamination of the processed carcasses. The organic acid products are readily available, inexpensive and do not create manufacturing problems. They do not require special handling of the feeds during storage, transport or feeding; they are natural compounds and are completely metabolized; there is no residue problem after their use.
3) Investigations have concluded that specific sugars inhibit the adherence of certain enteropathogenic bacteria to epithelial cells. Such sugars could be added to the drinking water or mixed into the feed. The best results have been achieved in combination with a distinct microbial flora. Such enhancing microorganisms can be cultured, lyophilized and mixed into the feed or water or given orally. This procedure, which is highly effective, is now in the process of being patented by the United States Department of Agriculture.

Practical Means to Reduce *Salmonella* Cross-Contamination during Slaughtering and Processing of Animals

A clear objective of the slaughter process is to produce meat from the carcass in such a way that the transfer of material and bacteria from the unclean parts of the animal onto the final carcass is avoided.

Careful analysis of the critical control points during slaughter of animals revealed that some could be kept under proper control by improvement of slaughter technology.

1) In particular, a new sticking device for an automatic system has been proven to be effective in reduction of cross-contamination at the stick wound (the stab hole).
2) The parallel-intermittent slaughter line developed in the Netherlands may significantly improve the hygienic quality of meat. This process minimizes possible cross-contamination of the carcasses.
3) Use of high-pressure jets (700-4000 bars) for splitting, skinning, dehiding, evisceration and cutting with an abrasive salt may have good results since direct contact between the cutting system and the carcass or meat is thus avoided and hygiene improved.
4) A mechanized system for slaughtering and dressing of ovines implemented in New Zealand permits significant reduction of surface contamination of carcasses by new machines which hygienically dress slaughtered animals.
5) Promising experiments with closure of the anus by a freezing plug have been carried out in Denmark. This method provides a reliable and impervious closure of the rectum until the time when it is hygienically removed together with the intestines without any contamination of the carcass.
6) It has been established that surface *Salmonella* contamination of poultry carcasses can be drastically decreased by chlorine in the chill system at 10-50 ppm, alkalizing of scald tank water to pH 9, and treatment of carcasses with 1-2% lactic acid before air chilling.

The effects of alkali treatment in combination with chlorination could decrease counts of non-spore forming pathogenic organisms to zero and need further investigation. *-The above new practical approaches are part of the outcome of a WHO Consultation on Salmonellosis Control in Agriculture which was held in Orvieto, Italy, on 9-12 April 1990.*

Poultry and Egg Salmonellosis

A number of countries have recently experienced a new situation with the emergence of *Salmonella enteritidis* as a major *Salmonella* serotype involved in foodborne disease in man. These cases are unique in that the food vehicle frequently implicated is eggs.

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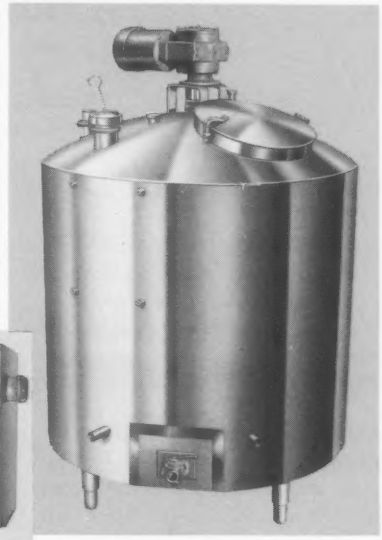

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From the epidemiologic point of view it is important to stress that this egg association may be due to the fact that *S. enteritidis* (together with *S. typhimurium*) being more invasive than other serotypes, may enter eggs before the shell is formed. The most likely mechanism for this is either ovarian infection or ascending oviduct contamination.

Evidence to date indicates that the incidence of this mode of transmission is rare and very difficult to detect. However, the enormous number of eggs produced for human consumption and the way eggs are used make even this low incidence significant.

In breeding flocks, this aspect of infection increases the possibility of transmission from generation to generation over and above the common route found with other *Salmonella* serotypes, via shell contamination and penetration. This vertical transmission is amplified within the hatcheries and rearing farms where other chickens become infected with the *Salmonella* organism.

It appears that poultry may become contaminated with *S. enteritidis* via other routes of infection such as feed, water, vermin, birds, insects and the environment, although this happens less than with other serotypes (e.g. *S. typhimurium*).

There are at present 33 recognized phage types (PT) of *S. enteritidis*. Almost all of the increase in England and Wales is due to PT4. In the United States of America, PT4 is not present as yet. To date, PT7, 8, 9, 9b, 13a and 23 have been identified in that country. The domestic cases of salmonellosis in Sweden are due to PT1 or 8, while infections acquired abroad are due to PT4.

The latest research results in connection with *S. enteritidis* reveal that this serovar has a relatively high, but not unusual, resistance to heat. The time needed to kill 90% of the bacteria at 55°C in homogenized whole egg (D-value) is about 6 minutes, i.e. more than for *S. typhimurium*, but less than for *S. senftenberg*.

S. enteritidis could survive in eggs boiled for 4 minutes (under experimental conditions). When inocula of only 1000 cells of *S. enteritidis* PT4 per egg yolk were tested, survival after 7 minutes of boiling could be observed. In addition, when eggs were inoculated with only 10 *S. enteritidis* PT4 cells per egg yolk, within 2 days at room temperature, they had multiplied to over 1000 million (10^9) per egg yolk.

To control the problem of *Salmonella* at the poultry farm, it is necessary to recognize clearly all the feasible epidemiologic pathways and possibilities to remove reservoirs and sources of infection.

Source: ***WHO Weekly Epidemiological Record, Vol. 65, Nos. 38 and 39, 1990.***

Can. Dis. Weekly Report 12/15/90

Sanitary Design

A Mind Set

by Donald J. Graham
Senior Food Technologist
Sverdrup Corp.
St. Louis, MO

When today's engineers sit down in front of the ubiquitous CADD unit to initiate a design for a new or renovated food processing plant, they must make decisions that will have an impact for many, many years to come. These decisions will affect plant functions, production, building and equipment costs, environmental programs, flexibility of production and types of product that can be produced. Most importantly, these initial decisions will determine the sanitation and cleanability of the plant.

Engineers/designers must have a "mind set" that not only reflects state of the art engineering based on solid engineering principles but this "mind set" must also include sanitary design principles and practices. How is this elusive "mind set" developed?

Trade magazines will run the occasional article or checklist on sanitary design of a food processing plant, but most publications give sanitary design and construction little consideration. Two books exist on the subject and even these are in need of updating (1, 2).

Universities that grant degrees in Agricultural Engineering or Food Engineering are just beginning to include courses and information on sanitary design. Their reputation is at stake if their graduates cannot design a food processing plant that is cleanable, meets all regulatory requirements and meets the sanitation demands of the new, highly sophisticated products that are entering today's marketplace. The real test of the graduates is if they can design a plant that will meet the sanitation demands of the products of tomorrow.

In reality, most engineers/designers of food processing facilities are going to have to dig out sanitary design information for themselves and attend courses such as the ones taught by the American Institute of Baking, by Sverdrup Corporation and by one or two others to learn the principles of sanitary design and have them engrained into their everyday thinking.

Where does sanitary design really start? It really begins with the decision to either build a new plant or to renovate an existing facility. Sanitary design covers the following:

Exterior

1. Site selection
2. Site preparation
3. Landscaping
4. Building type and outside wall construction
5. Truck and rail docks
6. Receiving yards
7. Outside lighting
8. Roof construction
9. Windows and openings
10. Pest control

Interior

1. Walls
2. Ceilings
3. Floors
4. Plant layout
5. Equipment layout
6. Lighting
7. HVAC
8. Piping and pipe racks
9. Insulation
10. Coolers and freezers including refrigeration units
11. Entrance and exit doors
12. Plumbing
13. Equipment supports
14. Catwalks and access platforms
15. Pest control
16. Employee facilities

Equipment

1. Equipment design
2. Food contact surface materials
3. Process systems
4. Storage bins and tanks
5. Use tanks
6. Electrical systems and equipment
7. Cleaning (CIP & COP) systems
8. Other wet cleaning systems
9. Dry cleaning systems

Waste Handling and Control

1. Solid waste
2. Liquid waste
3. Sewage control

Sanitary design covers all aspects of the design and construction of a food processing facility. The above list must be expanded or changed to meet the needs of the individual facility under consideration.

Site Selection

Site selection plays an extremely important part in the sanitary considerations of designing a new food processing facility. For example: if the site is next to and downwind of a chemical plant that emits some powerful and noxious odors,

special precautions are required in order to keep these odors out of the plant and out of the products. This is especially important if the products are relatively high in fat as fat readily picks up off odors and flavors. The same holds true for a site next to a sanitary waste disposal plant. Pathogenic bacteria can be picked up by the wind during the sewage treatment and can be blown into the plant and contaminate product unless special filters are added to the intake air systems. Sites located next to large bodies of water can become inundated with seagulls and other scavenger birds. These birds must be prevented from perching on the building or nesting in or on the facility. Birds carry *Salmonella* and other bacteria that can cause food-borne illness. Good water drainage affects sanitation. Standing water provides breeding places for insects and provides water to sustain the lives of rodents and other pests.

Another consideration is the site's previous occupants. Was it a toxic waste dump and therefore contains possible product contaminants. Or was it just a waste disposal site (unofficial waste site, that is) and now produces methane gas that can not only affect product flavor but is also highly dangerous if concentrations are allowed to build up within the new facility.

In any site selection procedure many things must be considered. However, sanitary consideration questions must be continually asked about the conditions at and around the site that could affect the products to be produced in the plant.

For existing plants, on-site conditions and local area conditions are the concerns of sanitary design. What other industries have grown up around the existing site and do they have any contaminating effect on the food product being produced? If there is a problem, then the design for renovation must provide for keeping the contamination out of the plant. For example, a meat processing plant noticed that at certain times their meat products exhibited an off flavor. Investigation could not find anything within the plant that could contribute to the off flavor. However, it was noted that a chemical plant had gone on stream about the same time the off flavors appeared. To stop the contamination, air handling units were upgraded with better filters and deoderizing units installed. Unless an offending neighbor can be talked into correcting the problem affecting the food facility, the processor has to protect the product from the neighbors.

Site Preparation

Sanitary design enters into site preparation too. Toxic materials must be removed to prevent the possibility of their becoming a potential food product contaminant. The site has to be graded to prevent standing water which acts as breeding sites for insects and mosquitos. Adequate storm sewers should be provided to accomodate rain water run off. Parking lots and roadways should be paved to keep dust to a minimum. Actual steps for site preparation depend on the configuration of the site selected. Here again, the engineer and designer must continually evaluate each step of the design to assure it meets all the criteria for erecting a facility to produce clean, sanitary food products.

Landscaping

Many municipalities demand extensive landscaping for processing buildings and offices. The idea is to make them fit a certain standard of neatness and attractiveness to remove the image of the stereotypical factory. However, the various regulations do not take into account sanitary criteria that requires all shrubbery to be at least 30 feet away from a building to eliminate hiding places for various forms of rodents and insects. This sanitary guideline sometimes clashes with city ordinances and compromises must be worked out. Good sanitary design takes this into consideration.

Grass coverings must end 30 inches from the building walls so a 3 to 4 inch deep gravel strip can be laid down to provide a clear area for rodent control and to discourage them from coming out into the open along the plant walls. This gravel strip should consist of a sheet of 2 or 3 inch poly film such as VisQueen underneath a 3 to 4 inch depth of pea gravel. Pea gravel is very hard to tunnel through and will not stack or hold a shape, thereby discouraging rodents from burrowing into it.

Trees are attractive on a plant site but they should not contribute a source of contamination to food products. Trees can add a great deal to attractive plant grounds, but they too should be at least 30 feet away from the plant building. Trees attract birds to the plant and provide nesting and roosting places. Certain species of trees are known to attract insects and should be avoided.

References

1) Inholte, T., Engineering for Food Safety and Sanitation. Thompson and Co., Minneapolis, Mn. 283 p.
2) Katsuyama, A., Strachan, J., (Ed.), Principles of Food Processing Sanitation. Food Processors Institute. Washington, DC, 303 p.

In the next column the building type and outside construction considerations will be discussed.

About the author . . .

Don Graham is Senior Food Technologist for Sverdrup Corporation, a St. Louis based provider of total project management services for business and industry. Among Sverdrup's specialities is the planning, design and construction of food plants.

Mr. Graham is a graduate of Michigan State University with an M.S. in Food Science. Before joining Sverdrup, he served in various technical and technical management positions with Green Giant Company, Green Giant of Canada, Wm. Underwood Company, and finally as Technical Director of the International Group at Pet, Inc., (Whitman Corp.).

Since joining Sverdrup, he has served as a member of peer review groups for food processing, TPM (Total Project Management) projects, taught food sanitation courses to Sverdrup engineers, and to food client engineering staffs. He has worked on individual projects dealing with various stages of TPM for food clients.

He is also a member of the Food Processors Institute Curriculum Committee, a professional member of the Institute of Food Technologists, International Association of Milk, Food and Environmental Sanitarians and the Institute of Thermal Processing Specialists.

Federal Register

Environmental Protection Agency

Availability of Pesticide Reregistration Eligibility Document for Sulfur

Agency: Environmental Protection Agency (EPA).

Action: Notice of availability for public comment.

Summary: This Notice announces the availability of the final Reregistration Eligibility Document (RED) for Sulfur and the establishment of a public comment period. The RED is the Agency's formal regulatory assessment of the health and environmental data base for sulfur and presents the Agency's determination regarding which uses of sulfur are eligible for reregistration.

Dates: Written comments on the Sulfur RED must be submitted by August 5, 1991.

Addresses: Three copies of comments identified with the docket number "OPP-34013" should be submitted to: By mail: Public Information Branch, Field Operations Division (H7506C), Office of Pesticide Programs, Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460. In person, deliver comments to: Room 246, CM #2, 1921 Jefferson Davis Highway, Arlington, VA. To request a copy of the RED or a RED Fact Sheet for sulfur, contact the Public Information Branch, in room 246 at the address given above (703-557-2805). Requests should be submitted in time to allow sufficient time for receipt before the close of the comment period.

Information submitted as a comment in response to this Notice may be claimed confidential by marking any part or all of that information as "Confidential Business Information" (CBI). Information so marked will not be disclosed except in accordance with procedures set forth in 40 CFR part 2. A copy of the comment that does not contain CBI must be submitted for inclusion in the public docket. Information not marked confidential will be included in the public docket without prior notice. The public docket and docket index will be available for public inspection in room 246 at the address given above, from 8 a.m. to 4 p.m., Monday through Friday, excluding legal holidays.

For further information contact: Eric Feris for Technical questions concerning the RED. (Call through the Federal Information Relay Service at 1-800-877-8339. When the operator answers, ask to call Mr. Feris at 703-308-8048).

Supplementary Information: EPA has issued a final Reregistration Eligibility Document for Sulfur. Under the provisions of the Federal Insecticide, Fungicide and Rodenticide Act, as amended in 1988, EPA is conducting an accelerated reregistration program to reevaluate most existing pesticides to make sure they meet current scientific and regulatory standards. Sulfur has a complete data base and the Agency has determined that the registered uses do not cause unreasonable adverse effects to people or the environment. All registered uses of sulfur are eligible for reregistration. All registrants of sulfur have been sent the RED and must respond to the labeling requirements within 8 months of receipt. The 60 day public comment period does not affect the registrant's response due date.

EPA's rationale for issuing the Sulfur RED as a final document with a 60 day comment period is based on the Agency's experience with Registration Standards and comments received from the public at a reregistration workshop sponsored by the Agency in September 1990. Most of the participants at the September 1990 workshop, which included several hundred registrants, State and Federal agency representatives and public interest groups, expressed a desire to have an opportunity to comment on a draft RED prior to the Agency issuing the final document. Most comments were from affected registrants and involved clarification of data requirements and/or questions about the appropriateness of certain data and/or labeling changes; public comments on the Registration Standards were limited. The Agency believes registrants will have ample opportunity to raise additional issues prior to the due date of their responses or in their responses. Although the Agency is issuing the Sulfur final RED it believes that the establishment of a 60 day comment period will provide sufficient opportunity for public input and allow a mechanism for any subsequent amendments to the RED. The Agency believes this approach is necessary to reduce the time required to complete the regulatory assessment and issue RED's for all affected pesticides and meet the congressionally mandated time frames for completion of the reregistration program.

Dated: May 10, 1991

Douglas D. Campt,

Director, Office of Pesticide Programs.

(FR Doc. 91-13235 Filed 6/4/91; 8:45 am)

Federal Register/Vol. 56, No. 108/Wednesday, June 5, 1991/Notices

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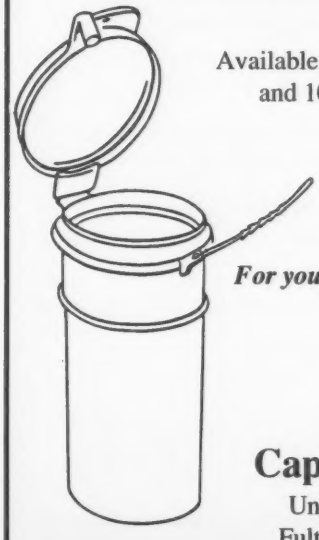

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Updates . . .

Dick B. Whitehead

3-A Committees Spring Into Action

The Spring 1991 3-A Sanitary Standards Committees meeting was held May 13-17 in Milwaukee, Wisconsin, with an estimated 100 attendees per day participating in committee reviews.

An award for Distinguished Service was given to 3-A Committee Chair Dick B. Whitehead by the International Association of Milk, Food and Environmental Sanitarians, Inc. (IAMFES). This award was given in appreciation for over 50 years of meritorious service and dedication to IAMFES, for being Chairman of the Committee on Sanitary Procedures for over 20 years and for his lifelong commitment to Food Protection and Public Health.

The ultimate goal of the 3-A system, protecting dairy products from contamination, has remained the same over the last 50 years. To be sure, voluntary compliance with the standards set forth by the committees continues to increase as equipment manufacturers, processors, and all those involved in the dairy and food industry look toward the next century.

Dr. Thomas Gilmore, 3-A Secretary and Technical Director at DFISA, said that he would like to see continued improvement in the 3-A review process and an increased participation from the sanitarian and processor interest groups.

"3-A was a good idea 50 years ago," he said. "It's a better idea today."

IAMFES Secretary Winner

Dee Clingman through vote of the IAMFES membership will begin his term on the Executive Board at the 78th Annual Meeting in Louisville, Kentucky in July, 1991.

For more information on Dee please turn to the News section on page 376.

Be Sure to Attend the IAMFES 78th Annual Meeting this Month!

The IAMFES 78th Annual Meeting in Louisville, Kentucky, is something you won't want to miss. This educational event will feature over sixty exhibits during July 21-24. You can see the latest in technology, product innovation, and new information.

The 78th Annual Meeting will feature three days of sessions, symposia and exhibits, with over 100 technical presentations. Participants in this year's meeting include some of the most respected authorities in food safety, public health, research microbiology and sanitation. More information about the details is available by calling IAMFES.

An all new Poster Session will be available for people to see. These will help inform attending members on how to best achieve the highest degrees of safety and quality. The sharing of this information will not only help to solve problems, it will bring together those with mutual interests and renew friendships. There will be approximately eighteen poster presentations on Wednesday, July 24, from 9:00 to 11:30 a.m. with the authors present to answer any questions.

Not only will you get the best in information, you will get the best in social events. Sunday, July 21, starts the events off at 8:15 p.m. with a complimentary Cheese and Wine Party held in the Exhibit Hall. This provides a great opportunity to greet friends, make new ones, and view the exhibits. On Monday, people can enjoy the Belle of Louisville Dinner Cruise with a delicious dinner, live band and dancing. The dinner cruise will begin at 7:00 p.m. and take you floating down the "Beautiful Ohio." The IAMFES Annual Awards banquet will be held on Wednesday, July 24 with a reception at 6:00 and banquet at 7:00 p.m. At the banquet, awards will be given for Sanitarian, Educator, Citation, Harold Barnum Industry, and Honorary Life Memberships. The awards banquet is a time to give outstanding IAMFES members the recognition they deserve.

Passes can also be obtained on July 22-23 to the Exhibit Hall only. These are available for a nominal charge.

IAMFES, in conjunction with the Kentucky Association of Milk, Food and Environmental Sanitarians, Inc., is proud to sponsor this educational event for you and your colleagues. For information on registration, hotel information, or more details, call IAMFES at 1-800-369-6337 (US) or 1-800-284-6336 (Canada) and ask for Julie or Margie.

Industry Products

L&N's New Submicron Particle Analyzer Handles Concentrated Samples with Little or No Dilution

Leeds & Northrup's new MICROTRAC® Ultrafine Particle Analyzer (UPA) can measure size distribution of particle concentrations with little or no dilution in the production of pharmaceuticals, paints and pigments, photographic materials, plastics, and other products.

While other submicron analyzers require great dilution, the UPA uses L&N's unique Controlled Reference Method. In this method, Doppler-shifted laser light, back-scattered from particles, is compared to a reference beam internally reflected at the sample-waveguide interface. Since required sample penetration is very shallow, concentrated, highly-absorbing dispersions may be analyzed. The UPA also employs a powerful algorithm which allows analysis of all kinds of distribution–ranging from narrow to broad, with single or multiple peaks, or with tails.

The UPA is the newest addition to the L&N MICROTRAC Particle Size Analyzer Series 9200 which covers the complete range of particle sizes from 700 microns down to 0.005 micron (50 Angstroms). A MICROTRAC system is built with modular building blocks so that users can start small and add to the system as needs grow.

Leeds & Northrup - North Wales, PA

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Improved Milk Screening Tests Cut Testing Time; Aflatoxin M_1 Test Added to Lactek™ Family

A new LacTek™ milk screening test protocol cuts testing time almost in half, while maintaining the original high performance standards, it was announced today by Idetek. Now, users can easily screen up to five milk samples for the presence of beta-lactams or a variety of other residues in only seven minutes while benefiting from LacTek's specificity, sensitivity, precision and ease-of-use.

The new Lac-Tek tests take only two minutes of "hands-on" time and are significantly faster overall than other milk screening methods, which take from twelve minutes to three hours. Shorter testing times mean faster unloading of milk trucks and less work for dairy receivers and laboratory technicians.

Idetek also announced the addition of a new Aflatoxin M_1 test to the LacTek family of milk screening tests. The new test uses the same simple procedure as the LacTek beta-lactam, sulfamethazine, and gentamicin kits. Aflatoxin residues at the FDA regulatory action level of 0.5 ppb can be easily and reliably detected in raw, pasteurized or reconstituted milk powder in less than seven minutes.

LacTek tests are highly sensitive, accurate and easy-to-use. Using proven ELISA (enzyme-linked immunosorbent assay) technology–the same technology used by many medical diagnostics–the tests are safe, stable and non-radioactive. Independent validations of the LacTek kits has shown each to be rugged and reliable and to closely agree with official methods. Variations in milk composition, high somatic cell counts, high bacterial count and other residues do not interfere with the performance of LacTek tests.

Tests are performed in specially-coated test tubes using the LacStation™II and an easy five-step procedure that reduces hands-on time to two minutes and requires no specialized training. A different color intensity readily distinguishes positive from negative samples. Idetek's intelligent reader/printer accurately interprets these color differences, eliminating subjectivity, and automatically prints a time-stamped test record. The LacStation™II also includes a test tube shaker and timer, reagent dispensers and an automatic test tube washing system.

LacTek tests are provided in kits of 20 or 50 tests with specially-coated test tubes and all other reagents including a reference standard. All kits are stable for at least six months.

Idetek, Inc. - San Bruno, CA

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Sterile Contact Plate Offered for Environmental Testing; Requires no Incubation for Sterility Confirmation

Becton Dickinson Microbiology Systems announces the immediate availability of a sterile contact plate and package for cleanroom environmental testing as part of a quality assurance program.

The prepared plate, marketed as the **BBL® Sterile Pack Contact Plate**, is formulated with Trypticase® Soy Agar, Lecithin and Polysorbate 80, and then double-bagged and gamma-irradiated. This sterilization procedure is consistent with current AAMI process control guidelines for gamma radiation sterilization of medical devices, thus making it unnecessary to incubate the plates for sterility confirmation prior to use.

The sterile plate helps maintain significantly better quality assurance, without additional steps or processes.

Product manufacturing and its packaging ensure sterility of each plate's testing surface prior to use. The package of plates is opened in the gowning room, where the outer bag is removed. The inner bag is passed through to the cleanroom, where it is opened and discarded. Plates may then be used to sample selected surfaces of production machinery, personnel or other cleanroom environmental surfaces.

After incubation, the quality assurance technologist counts colonies on the media surface, which contains a numbered grid for easy enumeration of recovery.

The BBL® Sterile Pack Contact Plate, double-bagged and irradiated, is available in packages of 10 plates from any Becton Dickinson Microbiology Systems distributor, catalog no. 21961.

Additional BBL® prepared media are also available for environmental monitoring applications. These include the D/E Neutralizing Contact Plate, Standard Methods Agar with Lecithin and Polysorbate 80, **Trypticase®** Soy Agar with 5% Sheep Blood (**TSA II®**), **Trypticase®** Soy Agar with Lecithin and Polysorbate 80 (**RODAC®**) **Trypticase®** Soy Agar with Lecithin and Polysorbate 80 (with label), and **Trypticase®** Soy Agar with Lecithin and Polysorbate 80 (double bag, non-irradiated).

Becton Dickinson Microbiology Systems
Cockeysville MD

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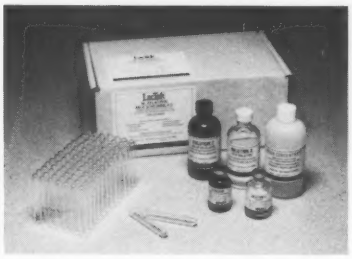

Bio Techniques Launches New Cobactin® Dairy Product Nationwide

Bio Techniques Laboratories, Inc. announced today the nationwide introduction of its Cobactin® Dairy product. The product is a patented microbial feed additive specially formulated for dairy cows.

Like the Company's successful Cobactin® Beef product, now at use on over 15% of the major U.S. feedlots, Cobactin Dairy has undergone extensive trials and University studies to ensure effectiveness. Trials have shown that Cobactin Dairy caused an increase of 2.9 pounds of additional milk per cow per day.

"Cobactin Dairy's outstanding performance has attracted the attention of some of the top dairy managers, and we're pleased now to be able to offer it to distributors on a nationwide basis," said Doug Ware, Ph.D., Vice President of Bio Techniques. The company is in discussions with a number of distributors and is actively seeking arrangements with organizations interested in distributing the product.

Bio Techniques Laboratories, Inc., founded in 1983, researches, develops and markets advanced products for the agricultural industry.

Bio Techniques Laboratories, Inc.
Redmond, WA

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Nasco Revises Sampling Equipment Catalog

The latest Sampling Equipment Catalog is now available from Nasco, Fort Atkinson, Wisconsin, and Nasco West, Modesto, California. Nasco's Sampling Equipment Catalog has been revised wtih the newest supplies and equipment available in the sampling field. Offering a full range of sampling supplies, the catalog covers everything from milk and food sampling, to medical and veterinary sampling, to soil and wastewater sampling.

Nasco's Whirl-Pak® sampling bag is one of the major items featured in the catalog. Simple and easy to use, the Whirl-Pak® bag has become the most widely-accepted and used container for sample collection. And now, all Whirl-Pak® bags have been redesigned with new "PUNCTURE PROOF TABS." These special tabs are designed to prevent possible puncture and contamination.

Nasco continues to search for innovative sampling supplies. This 32-page catalog introduces the new "Speci-Sponge"–Nasco's sterile environmental sampling sponge. "Speci-Sponge"is a low-cost, effective, and convenient absorbent sponge designed specifically for testing laboratory surfaces and equipment for the presence of Listeria, Salmonella, etc. After adding diluent and wiping the surface to be tested with the moistened "Speci-Sponge," simply place the sponge in its special Whirl-Pak® bag and return it to a testing laboratory for analysis.

This comprehensive catalog includes a wide variety of sampling equipment. Choose from test bottles and pipettes; sampling spoons, scoops, and dippers; bottle brushes; carrying racks; thermometers; stomacher bags; Babcock test calipers; timers; bucket augers; and more. For your free copy of Nasco's Sampling Equipment Catalog:

Nasco - Fort Atkinson, WI

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Walker Stainless Equipment Co. Announces Rental Plan for 150 Gallon Cone Bottom Kettle

This 150 gallon cone bottom kettle will be available on a rental basis for experimental processing in customer's plant, to determine proper processing methods for new products and to develop improved product quality, flavor, texture and physical characteristics. Actual operating conditions may be simulated to determine cost savings and verify processing method and vessel design. The Rent-A-Kettle is completely portable; it rolls on casters or is easily transportable by forklift.

Some of the features of the rental unit include:

1. Type 316 stainless steel product contact surfaces.
2. Closed top with sealed openings allowing 10 psig pressure or full vacuum operation.
3. Variable speed scraper agitator assemply with removable nylon blades.
4. Cone bottom pitched 30° to center outlet for rapid unloading of heavy bodied product.
5. 2 zone heat exchange surface, separately controllable, for processing partial batch without burn-on. May be used with steam, water and/or glycol. ASME Code Stamped for 75 psig at 250°F.
6. Klenzade sprayball installed in dome for in-place cleaning of complete vessel appurtenances. No disassembly or hand cleaning necessary.
7. Steam controls mounted on vat including steam pressure reducer, Dial-a-matic temperature controller, strainer and condensate trap.

Once the proper combination of operation methods and equipment specifications have been established by the test unit performance, larger production units can be selected from our complete line of processing vessels.

For detailed specifications contact:

Walker Stainless Equipment Co.
New Lisbon, WI

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Sprinkman's New Vacuum Breaker and Vacuum Prevention Device

W.M. Sprinkman Corporation introduces a new Vacuum Breaker and Vacuum prevention device that works!

This new vacuum breaker is very cost effective, constructed with all stainless steel wetable parts for ease of cleaning. Will work day in and day out, preventing wasteful and messy start-ups. This vacuum breaker has been given authorization to apply the 3A symbol and complies with the construction criteria of the Grade A Pasteurization Milk Ordinance. Available in all sizes and fittings.

Midwest Food Supply Co., Inc./Division of W.M. Sprinkman Corp. - Waterloo, IA

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Ultra-Hot Series Model HU-1002-OM12

Mi-T-M® Corporation offers the most innovative design in hot water power washers - Ultra-Hot Series. Hot water high power washer generates 1000 PSI at 2 GPM. Designed with the user in mind this model features a slide-out pump/motor assembly for ease of serviceability and maintenance, large capacity corrosion-proof fuel tank with gauge, smooth running General triplex pump, condensation free "cold wrap" heat exchanger for safety, 50 foot hose, 35 foot electric cord with GFCI, and trigger controlled gun. Major components are covered by a noncorrosive polyethylene body to protect the machine from the hazards of weather, detergent spray-back, and other corrosive conditions. Many optional features are available including stainless steel outer coil wrapper, steam combination and adjustable low pressure detergent injection.

Mi-T-M Corp. - Peosta, IA

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New Bulk Tank Sampler Meets FDA Standards

The Milk Safety Branch of the U.S. Food & Drug Administration recently reviewed the Pro-Rate Strata™ Sampler for bulk milk and found it to comply with the construction criteria for use under the Grade A Pasteurized Milk Ordinance.

Capable of taking more accurate samples with less agitation, the Pro-Rata Strata Sampler is designed to be used in place of the dipper for collecting manual samples of milk and other fluids.

Made by Liquid Sampling Systems Inc. of Cedar Rapids Iowa, the stainless steel Strata™ Sampler is available in lengths for sampling farm bulk tanks, drums and transports. It includes sanitizing case and cleaning brushes.

Liquid Sampling Systems, Inc.
Cedar Rapids, IA

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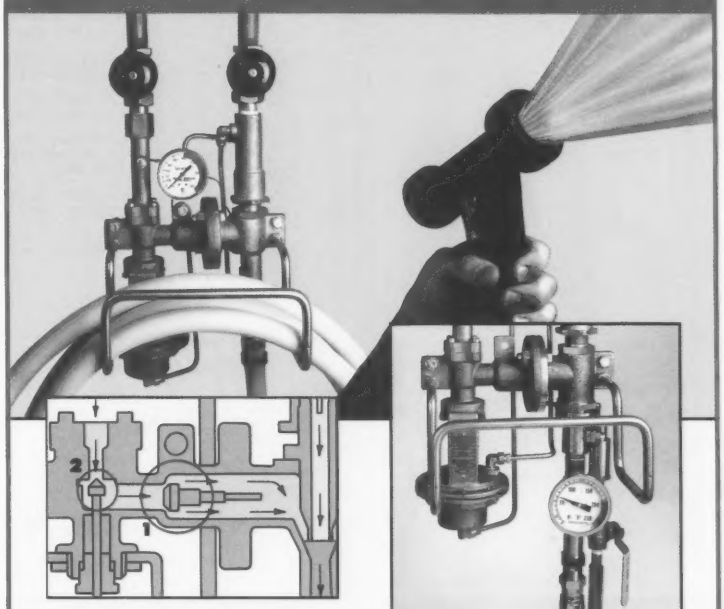

▲ *We eliminate "seize up" by putting a check valve (1) in the right place to prevent cold water from depositing carbonates around the steam valve (2).*

► *Inexpensive Model WD2000D uses maintenance-free Penberthy injector technology to add liquid detergent to hot water stream.*

1 Safe, low-maintenance design.

Penberthy washdown stations mix steam and cold water to provide **hot water on demand**—without the maintenance and safety problems that plague competitive units. Our stations reduce deposit buildup to practically zero. We put a check valve **in the right place** to prevent cold water from depositing carbonates around the steam valve—so it won't seize up!

2 Application versatility.

Besides our standard WD2000 unit, we offer a 2000L, designed to operate with steam pressure as low as 10 PSIG, or off waste steam. Also available is the 2000H, operating with steam pressures as high as 200 PSIG. And all Penberthy washdown stations are **mount-compatible**. Simply disconnect theirs and install ours—no re-piping necessary.

3 Low-cost detergent model.

Our 2000D detergent model makes it a cinch to add liquid detergents to the hot water stream, right out of a standard 55-gallon drum or any other container. Compare this compact, inexpensive, and low-maintenance station to their cumbersome, expensive "portable" unit.

Need any more reasons to specify Penberthy?
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- Through equipment designs which lend themselves to effective, efficient sanitation procedures.

We prohibit their introduction and growth with two further techniques. First we use blowers, returns and diffusers which deliver airflow volumes and patterns that eliminate the spectre of uncontrolled infiltration and dead air spaces. Secondly, our specially designed systems dramatically reduce the number of "high potential" collecting and growing surfaces found in conventional air handling equipment.

Finally, King equipment employs strategically placed filtration systems that capture yeast, molds, bacteria and other airborne contaminants down to 0.3 microns.

If you feel it is time to review your own air quality standards, please feel free to call us. We have an excellent booklet which outlines the practical points you should address in the control of airborne contaminants.

Even if you simply want to discuss your current situation with one of our food plant specialists, we'll be happy to take your call. Later, if you feel it's appropriate, we'll forward you complete technical literature on King's specially designed environmental control HVAC systems for food plants.

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Affiliate News

Illinois Milk, Food, and Environmental Health Sanitarian Meeting April 30, 1991 Woodfield Hilton Hotel Arlington Heights, Illinois

This was our annual joint meeting with the Chicago Dairy Technology Society.

The meeting was a tremendous success with over 130 registrants. We credit the record attendance to:

1. The printing of our first newsletter with over 900 copies mailed out seven weeks ahead of the meeting.
   The eight-page newsletter outlined the conference, told about our organization, and was full of information for the professional sanitarian. The newsletter was spearheaded by Secretary/Treasurer Robert Crombie.
2. The excellent program which was organized by First Vice President Charles Price.
3. The cooperation and support of the Chicago Dairy Technology Society.

Welcome and announcements were given by President Joe Delaney.

The first speaker was Shirley Bohm of the Illinois Department of Public Health. Shirley discussed Microbiological and Chemical Safety in Retail Meat and Poultry Plants.

Charles Phillips of the U.S. Food & Drug Administration gave a presentation on current issues in Retail Food Protection.

Doug Engebretson from Land O' Lakes, Inc. discussed Reduced Cholesterol milk.

Dr. David Evanson of Silliker Laboratories presented "*Salmonella enteritides* and its impact on Foods."

Dr. Ralph Cordell of the Cook County Department of Public Health recounted the Epidemiology and Field Investigations of Foodborne Illness Outbreaks by his department.

Ken Anderson of Harold Wainess & Associates reviewed the Milk Safety Issues of the 1991 N.C.I.M.S. Conference.

Following the social hour, dinner, and Chicago Dairy Tech's business meeting, Brian Rittger from Elanco Products discussed "B.S.T. Perspectives".

Our Fall Seminar is scheduled for October 15, 1991 at the same location.

Upcoming IAMFES Affiliate Meetings

1991

SEPTEMBER

•**12, Mississippi Association of Sanitarians, Inc.** will hold a mini-conference in Tupelo, MS. For further information contact Greg Geno, MS State Department of Health, 101 First Street, Booneville, MS 38829.

•**16-20, Wyoming Public Health Sanitarians Association** will hold their Annual Meeting at the Holiday Inn, Cheyenne, WY. For further information contact Terry Carlile, Box 1182, Laramie, WY 82070; (307)742-3611.

•**24-26, New York State Association of Milk and Food Sanitarians Annual Conference** will be held at the Sheraton Inn, Liverpool, NY. For more information contact Paul Dersam at (716)937-3432.

•**25-26, Wisconsin Association of Milk and Food Sanitarians, Wisconsin Environmental Health Association and Wisconsin Dairy Plant Fieldmen's Association Joint Education Conference** will be held at the Maritime Inn, Manitowoc, WI. For further information contact Neil M. Vassau, Publicity Chairman, P.O. Box 7883, Madison, WI 53707; (608)267-3504.

OCTOBER

•**15, Associated Illinois Milk, Food and Environmental Sanitarians Fall Seminar** will be held at the Woodfield Hilton Hotel, Arlington Heights, IL. For more information contact Bob Crombie at (815)726-1683.

•**16-17, Iowa Association of Milk, Food and Environmental Sanitarians, Inc. 50th Anniversary Annual Meeting** will be held at the Ramada Inn, Waterloo, IA. For more information contact Dale Cooper (319)927-3212.

NOVEMBER

•**13-14, Alabama Association of Dairy & Milk Sanitarians Annual Meeting** will be held in Birmingham, AL. For more information call or write Tom McCaskey, Department of Dairy Science, Auburn University, Auburn, AL 36849; (205)844-1518.

Pennsylvania Association of Dairy Sanitarians and Dairy Laboratory Analysts Holds Annual Conference

The Pennsylvania Association of Dairy Sanitarians and Dairy Laboratory Analysts Annual Conference was held May 13-15, 1991, at the Keller Conference Center, on the campus of Penn State University, State College, Pennsylvania.

There were over 200 people in attendance. The Conference covered a variety of topics relating to regulatory issues, laboratory issues and dairy farm issues. Mr. Steve Halstead, from the IAMFES office, also made a presentation with a very interesting slide show.

At the business meeting, election of new officers took place. Newly-elected officers are as follows:

President:	Mr. Donald Yanek
Past-President:	Mr. James DeTolla
President-Elect:	Mr. Tom G. Angstadt
Vice President:	Mr. Clifford Kendall
Treasurer:	Mr. Robert Mock
Secretary:	Mr. Michael John

The Association again sponsored three (3) scholarships to Penn State University in the areas of Food Science and Animal Science. These scholarships are some of the longest consecutive running scholarships in the College of Agriculture. These scholarships have been awarded for over 40 years.

At the Annual Awards Banquet, several awards were presented:

- Mr. Gerald Schick received the Distinguished Service Award.
- Ms. Carol Wallace received the Dairy Laboratory Award.
- Mr. Andrew A. Marvin received the Sanitarian Award.

All in all, the Conference proved to be a success.

Respectfully submitted,
James A. DeTolla, Past-President

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EVERYTHING YOU'VE ALWAYS WANTED TO KNOW ABOUT FOOD SAFETY BUT WERE AFRAID TO ASK...

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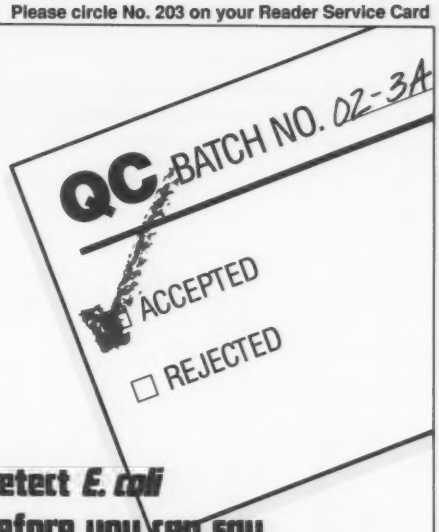

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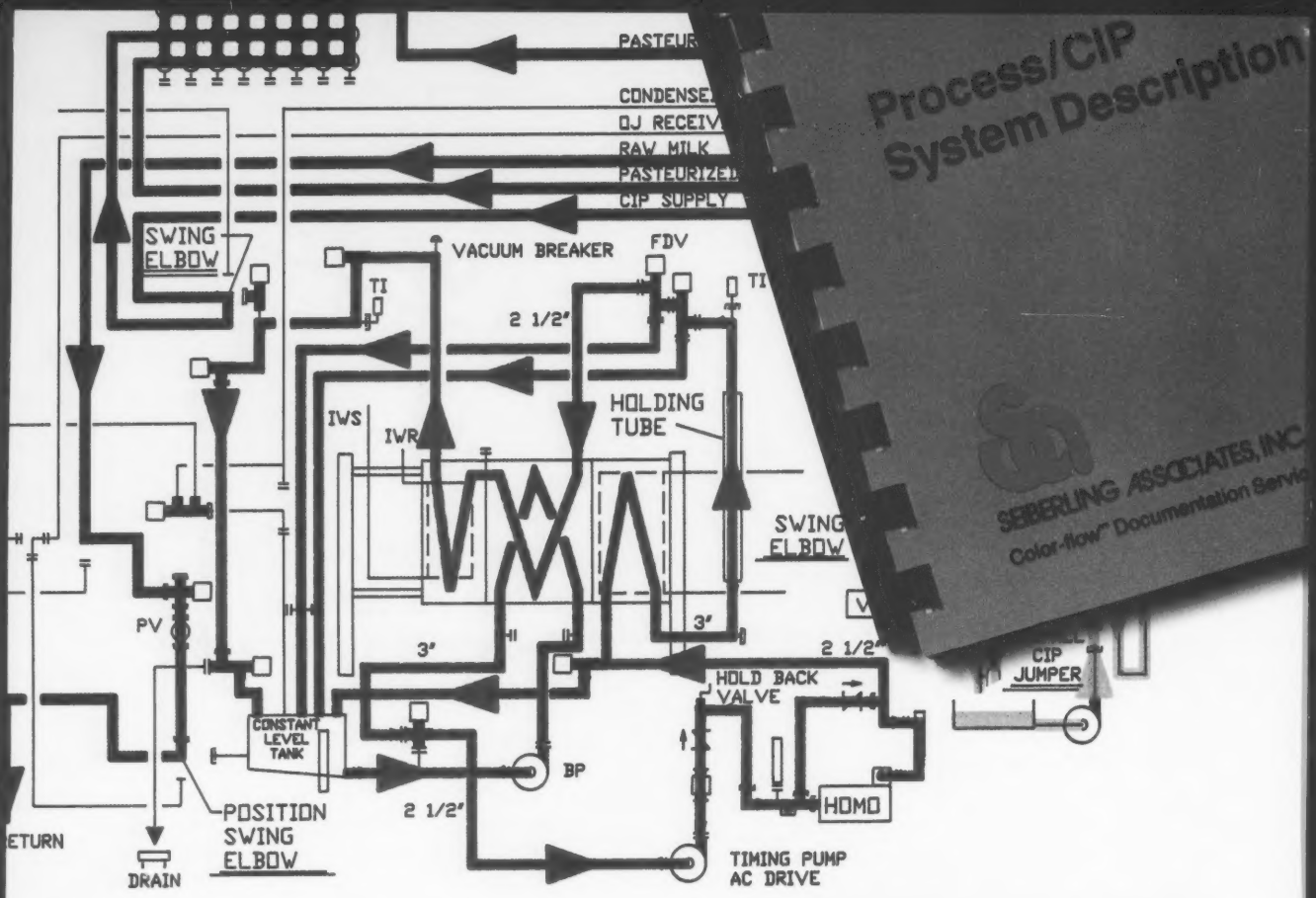

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Synopsis of Papers for the 78th Annual Meeting

Abstracts of papers to be presented at the 78th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, Inc. to be held in Louisville, Kentucky, July 21-24, 1991.

EVALUATION OF REAGENTS FOR USE IN RAPID METHODS OF ANALYTICAL FOOD MICROBIOLOGY
P.I. Peterkin*, A.N. Sharpe and E. Todd, Bureau of Microbial Hazards, Health Protection Branch, Tunney's Pasture, Ottawa, Ontario, Canada K1A 0L2

An automated method has been developed for the evaluation of molecular reagents useful in rapid methods of analytical food microbiology, against a large number of species or strains. The system is based on the use of the hydrophobic grid-membrane filter (HGMF), and a commercial image-analyzer, the HGMF Interpreter. Examples discussed will include the evaluation of indoxyl-B-D-glucuronide for the enumeration of *Escherichia coli*, the evaluation of polyclonal and monoclonal antibodies for a *Salmonella*-specific reagent, and the screening of DNA sequences during the development of a DNA probe for *Listeria monocytogenes*.

INCREASE QUALITY OF FOOD SERVICE INSPECTIONS Frederick Petersen*, R.S. Andrew, D. McBride, Marina Medvedev, Stamford Health Department, 888 Washington Blvd., Stamford, CT 06901

Irwin et al. (1989) found restaurants with poor inspection scores that related to improper food handling practices are at increased risk for foodborne illness outbreaks. One purpose of the Stamford Health Department's Food Service Surveillance Program is to protect the public health by inspection and rating of food service establishments. Hand held computers have improved the efficacy of this program. Complete inspection reports are generated by the computer on the inspection site immediately after inspection. The report provides legal references and directions for corrective actions. Inspectors save time in recording violations, thereby are freed up to communicate and educate the food service operator. Productivity of the inspector has increased. The number of inspectors has actually decreased from 7 in 1984 to 6.5 in 1990. The number of computerized inspections more than doubled from 508 in 1984 to 1,130 in 1990. Enforcement orders increased from 32 in 1984 to 191 in 1990. The program also produces standardized legible reports, inspection histories for each establishment, and through its upload capabilities, provides management reports for health department administration.

FLUOROMETRIC ANALYSIS OF ACID PHOSPHATASE IN MEATS FOR MONITORING COOKING TEMPERATURES, Richard M. Rocco, Advanced Instruments, Inc., Needham Heights, MA 02194

Methods are needed to monitor thermal processing requirements for meat and poultry products. A rapid 3 minute quantitative assay for acid phosphatase (ACP, EC 3.1, 3.2) has been developed for use with water extracts of heated meat. The method is based on a previously described fluorometric substrate for alkaline phosphatase (*J. Food Protection* 53:588, 1990). Working substrate for the ACP test contains 5 mG substrate in 50 mL acetate buffer pH 4.9 with 10% dimethylformamide. Lean ground beef (gluteus medius) was heated to 62.8, 65.5, 68.3 or 71.1 °C in a water bath set 1.5°C above the target temperature. At target temperature, tubes were removed and immediately chilled (0-2°C). Extracts (5 g meat to 10 g water) were prepared by high-speed blending, centrifuging and vacuum filtering.) A 75 µL aliquot of the aqueous meat extract was added to 2.0 mL of the working substrate in a fluorescence cuvette. The kinetic increase in fluorescence is monitored in a dedicated fluorometer at 38°C and printed after 3 minutes. Mean (N = 9) and standard error mU/Kg ACP cooked beef values were 5109 ± 221 (62.8°C), 3504 ± 92 (65.5 °C), 2063 ± 55 (68.3°C), and 733 ± 25 (71.1°C). Linear regression was mU/Kg ACP = 47284 - 291.35 (X) with R^2 = 99.82%.

A DIFFERENTIAL-SELECTIVE MEDIUM AND SIMPLE ATMOSPHERE FOR RECOVERY OF *CAMPYLOBACTER JEJUNI*, N.J. Stern*, B. Wojton and K. Kwiatek, Richard Russell Agricultural Research Center, USDA-ARS, POB 5677, Athens, GA 30613

We developed a productive, selective-differential medium for isolation of *Campylobacter jejuni* from chicken carcasses. The medium (Campy-Cefex: CC) consisted of Brucella agar, 5% lysed horse blood, 0.05% ferrous sulphate, 0.05% sodium pyruvate, 0.02% sodium bisulfate and antibiotic supplements of 35 mg/l sodium cefoperazone and 200 mg/l of cycloheximide. A total of 41 chicken carcasses were rinsed, and samples were plated onto CC, CCDA and Campy-BAP media. CC proved as productive and selective as the other media. By reading plates for transluscent colonies, CC allowed for easier differentiation of *C. jejuni* from breakthrough flora. We also tested 7 isolates of *C. jejuni* in microaerobic (5% O_2, 10% CO_2, 85% N_2) and dry ice generated atmospheres. The mean log10 cfu generated, using the same cultures and medium, were 2.07 and 1.81 for the microaerobic and dry ice atmospheres, respectively. These two developments allow for simplification of materials and methods required to isolate *C. jejuni* from foods.

METHODS FOR SELECTIVE ENRICHMENT OF *CAMPYLOBACTER* SPECIES FROM POULTRY FOR USE IN CONJUNCTION WITH DNA HYBRIDIZATION METHOD, N.J. Stern* and M.A. Mozola, Russell Research Center, USDA-ARS, Athens, GA

A DNA hybridization test initially described for use with human fecal specimens is being investigated for application to the detection of *Campylobacter* species in poultry samples. The test chemistry involves solution phase hybridization and detection by means of an enzymatically generated colorimetric endpoint. DNA probes used in the test system are targeted to unique sequences of ribosomal RNA and are specific for *C. jejuni, C. coli, C. laridis* and *C. fetus* subsp. *fetus*. Initial experiments with pure cultures of *C. jejuni* have established the sensitivity limit of the DNA hybridization assay at approximately 1 x 10^6 cells per ml. Results of experiments designed to define optimal conditions for recovery and selective enrichment of *Campylobacter* from poultry samples for use in conjunction with the DNA hybridization assay will be presented.

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78th IAMFES Annual Meeting Exhibit Preview

Acculab, Inc., Newark, DE—302-292-8888, Booth # 2

Acculab specializes in microbe identification. We can identify a wide range of aerobic and anaerobic bacteria and yeasts (including 8 species of *Listeria* and 9 of *Salmonella*). Reports on pure cultures that include identification to species or below are returned in 72 hours or less for an average cost of $45.00 per culture.

Advanced Instruments, Inc., Needham Heights, MA—617-449-3000, Booth # 10

Advanced Instruments will display the Fluorophos® line of rapid chemistry products for the dairy and food laboratory. The AOAC approved 3 minute Alkaline Phosphatase Test for finished dairy products; EIA procedures for Beta Lactams and Sulfamethazine, and a three minute quantitative acid phosphatase test for determining the temperature at which meats have been cooked. A new microprocessor controlled milk cryoscope will also be demonstrated, providing rapid analysis with automatic calibration and % added water display.

Ampco Metal, Incorporated, Milwaukee, WI—414-645-3750, Booth # 18

Ampco Pumps, part of Ampco Metal, Incorporated, manufactures centrifugal pumps in 316 stainless steel and nickel-aluminum-bronze construction. Displayed at the Annual Meeting is a "D" series cutaway in 316 stainless steel used for CIP/COP solutions. The "D" series of rugged construction is specially designed for hot solution service, low NPSH and conforms to the revised 3A practices for solution pipelines - Number 605-03.

Anderson Instrument Co., Inc., Fultonville, NY—518-922-5315, Booth # 30

The Anderson Instrument Company, Inc., is a manufacturer of indicating, recording and process-control instrumentation for the food and dairy industries. Displayed at the IAMFES Annual Meeting will be: a Safety Thermal Limit Recorder for HTST pasteurization control and featuring a dual RTD input and self-diagnostic circuitry which continuously monitor the integrity of its operation; a JD Differential Pressure Switch which controls critical HTST process pressures to prevent recontamination of pasteurized milk in the regenerator section of an HTST; the Differential Reference Thermometer which outperforms existing mercury-in-glass thermometers in all respects.

Aquionics, Inc., Erlanger, KY—606-341-0710, Booth #37

Advanced ultraviolet disinfection equipment for use in food and dairy industries. Applications include water, air, and surface disinfection. Dairy applications include disinfection of cottage cheese curd wash, sweet water, incoming plant water, make-up water for juice and beverages and captive cooling loops. Latest advances in equipment design include use of high intensity lamps, an automatic cleaning device, total monitorability and fail safe ground-fault detection interlinks which provide the keys to successful new applications.

Atkins Technical Inc., Gainesville, FL—800-284-2842, Booth #26

Atkins Technical manufactures digital thermometers, solid state recording thermometers, digital panel/wall/stem thermometers, and thermocouple thermistor and RTD temperature probes for food service, food processing, dairy and environmental health. New High Temperature Handle, Indicating Solid State Recorder with Probe.

Biolog, Inc., Hayward, CA—415-785-2585, Booth # 56

Biolog, Inc. will be exhibiting, for the first time at the IAMFES Annual Meeting, its test panels and instrumentation for identification of an extremely broad range of bacteria. The Biolog System can identify over 700 species including both pathogenic and environmental species. The Gram-negative panel (GN MicroPlate) can identify Gram-negatives important to the food industry: *Salmonella, Shigella, Escherichia, Yersinia, Vibrio,* and more. The Gram-positive panel (GP MicroPlate) can identify Gram-positives important to the food industry: *Listeria, Lactococcus, Streptococcus, Staphylococcus, Bacillus,* and more. Biolog also markets companion software and instrumentation to go with the test panels. The system can be used in either a manual mode or an automated mode of operation.

BS & B Safety Systems, Inc., Tulsa, OK—918-622-5950, Booth #39

BS & B Safety Systems, proudly announces the revolutionary type FRB-S rupture disk. It is a reverse buckling rupture disk device designed for pharmaceutical, biotech and other sanitary applications. The FRB-S is designed for use with standard 1 1/2" Tri-Clover™ clamped ferrels. The ultimate in explosion venting....VENT-SAF PLUS. Vent-Saf Plus providing explosion venting with a one piece construction. The faster response time of a one piece construction lessens the effect of an explosion. For all your safety needs, turn to the experts in rupture disks.....BS&B Safety Systems..... over 60 years of experience.

Becton Dickinson Microbiology Systems, Cockeysville, MD—301-584-8977, Booth # 13

Becton Dickinson Microbiology Systems (Booth #13) will exhibit products utilized for the cultivation and identification of foodborne pathogens, including *Salmonella* and *Listeria*. In addition the company will exhibit autoclave controls and a complete line of bottled media utilized in sterility testing and environmental monitoring.

Capitol Vial, Inc., Fultonville, NY—518-853-3377, Booth #12

We will display our All New Tamper Evident and Tamper Proof Vials, produced in a class 10,000 FDA certified clean room. Capitol Vial manufactures one piece, hinged top cap, leak proof, airtight (over 30 psi internal pressure) plastic sterile vials. In addition to various size vials, Capitol has a complete line of accessory items such as: automatic vial opener and closer, styrofoam vial shippers, poly cell rafts and wire racks to transport vials.

Carmel Chemical, Westfield, IN—800-544-8990, Booth #4

Carmel Chemical Corp. is a manufacturer of cleaning compounds, sanitizers and disinfectants. Carmel Chemical also manufactures a full line of fogging equipment and insecticides for pest control. For complete details, call toll free at 1-800-544-8990.

CEM Corporation, Matthews, NC—800-726-3331, Booth #62

Rapid Microwave Sterilization of Microbiological Media for Total Plate Counts. CEM Corporation introduces a new MicroClave™ Sterilization System to prepare and sterilize microbiological media in less than 10 minutes. The instrument performs sterilization in a fraction of the time required by the

autoclave. Sterilizing a wide variety of media in varying quantities on short notice provides media when it is most needed. Eliminates preparation of excess media and frees valuable storage space. Utilizing microwave energy, the instrument quickly heats the media to elevated pressures for a very brief period which make flash sterilization possible. Programmable control automatically maintains agar media at pouring temperature or remelts solidified agar. For more information, call (800) 726-3331.

Charm Sciences, Inc., Malden, MA—617-322-1523, Booth # 28

Charm Sciences, formerly Penicillin Assays, will present the latest technology in Charm Testing for food and dairy products: Rapid Charm Tests for Antibiotics, Aflatoxins and Alkaline Phosphatase. Recent innovations such as the 3 Minute Charm Transit Test and the Total Bacterial Count on the Charm II System will be introduced. The Auto-Timing Charm Farm Test, with built in programmable features, will also be displayed.

Columbus Instruments, Columbus, OH—614-488-6176, Booth #9

1) O_2/CO_2 Respirometer (MICRO OXYMAX) measures oxygen consumption and CO_2 production by bacteria and fungus. It can also be used to measure oxidation of fats and dairy products (e.g. powdered milk). Respirometer can simultaneously measure 20 samples under IBM-PC control. Resolution is 0.2 microliters O_2/hour. Chambers can be user's own in size 50ml to 20 liters. 2) Computerized Thermometer - 256 channels thermocouple interface to IBM-PC computers. Accuracy 0.1°C. Resolution 0.017°C. Supplied with graphic software.

Custom Control Products, Inc., Racine, WI—414-637-9225, Booth #49

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D B K, Inc., Corona, CA—714-279-5883, Booth # 53

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Difco Laboratories, Detroit, MI—800-521-0851, Booth # 7

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Diversey Corp., Wyandotte, MI—800-521-8140, Booth # 38

Exhibition will include the newest technology in cleaners and sanitizers. Included will be new gel technology, non-foaming acid iodine sanitizers and monitoring equipment that constitute the verification of clean concept in a HACCP program.

DQCI Services, Inc., St. Paul, MN—612-785-0484, Booth #16

DQCI SERVICES, INC. is a wholly owned subsidiary of DAIRY QUALITY CONTROL INSTITUTE, INC. DQCI Services was formed to market component samples for infrared testers and somatic cell samples. We also do special testing for our customers—such as Mojonniers, solids, etc. All DQCI Services samples and tests performed are done according to AOAC, *Standard Methods for the Examination of Dairy Products*. Our component and somatic cell samples meet the requirements of Wisconsin AG 107.

DTR Company, Modesto, CA—209-526-8691, Booth #57

DTR Company will be displaying their line of temperature recording instruments. We are introducing our new line of single use strip chart recorders that can be read from outside the case. These units are available in 4, 7, 16 and 30 day models. Also on display is our line of reusable digital temperature recorders. These units are user programmable to take samples at the rate of 1 per minute to 1 every 120 minutes. They are programmed and read using an interface device connected to an IBM compatible PC.

Educational Testing Service, Princeton, NJ—800-251-3663, Booth # 15

Educational Testing Service provides the Food Protection Certification Program to certify food service personnel responsible for prevention, detection and correction of foodborne illness in food service establishments. For more information contact the Program Director, Betsy Willey, 1-800-251-3663.

Escort Instruments of America, San Francisco, CA—415-826-2282, Booth # 44

Continuous time, temperature and humidity monitors are self-contained, computer programmed quality assurance devices. As pocket size, portable units, these monitors are highly accurate, flexible, durable, easy-to-use and price-competitive. They are currently used by both fortune 500 corporations, as well as, small companies during testing, manufacturing, storage, transport and display. They are ideal for use in applications such as ice cream/dairy, fruit degreening rooms, potato storage, hen-houses, hatcheries, hi-tech clean rooms and various processed foods.

Charles Felix Associates, Leesburg, VA—703-777-7448, Booth #51

Charles Felix Associates is a consulting firm specializing in public health promotion, particularly in the area of food safety. The CFA exhibit offers samples of CFA publications: *Food Protection Report* and *Food Talk*; also materials from CFA clients relating to single service (the Foodservice & Packaging Institute) and ice sanitation (the Packaged Ice Association).

Foss Food Technology Corp., Eden Prairie, MN—612-941-8870, Booth #1

Foss Food Technology will be featuring the AutoSampler and BactoFoss. The AutoSampler takes an aseptic, representative sample from bulk tanks or milk plant. Sampling is performed continuously during the entire flow period to give the desired volume. The instrument is simply adjusted to the flow rate/pump capacity in the estimated volume of the liquid to be sampled. Sampling starts automatically when liquid flow past, and is independent of the pumping system. When the liquid volume is transferred, sampling is completed. The BactoFoss

provides a fully automatic bacteria count reading in raw milk in less than three minutes. The BactoFoss provides reliable and immediate microbiological quality test, enabling a cost effective administration of raw milk. The BactoFoss is based on bioluminescence, a technology giving it accurate and reliable bacterial count in a very few minutes.

H.B. Fuller Company, Monarch Division, Minneapolis, MN—800-328-4594, Booth #19

Monarch Division of H.B. Fuller Company is a market-driven company that delivers quality sanitation chemicals and value added services to the food processing and dairy farm industries.

Funke Dairy Supplies, Inc., Newtown, OH—513-272-3100, Booth #52

FUNKE DAIRY SUPPLIES, INC. led by Wm. F. Funke, president/owner, has serviced the dairy and food industry for 25 years. FUNKE DAIRY SUPPLIES sells frozen concentrate "Handi-Set" cultures, vitamins, stabilizers, etc., along with filtration products to prevent contamination in air blow, water, ice cream over-run, blow mold systems, etc., plus providing sterile air filtration requirements to meet your needs.

General Polymers, Cincinnati, OH—513-761-0011, Booth #54

General Polymers, a leader in resinous flooring technology for over 25 years, introduces Macroseptic flooring systems. Macroseptic floor systems contain Intersept^R which is an E.P.A. registered antimicrobial agent which inhibits the growth of a broad spectrum of Gram-positive and Gram-negative bacteria, a variety of fungi, yeasts and viruses. Offering the only seamless flooring system with a build-in biostat.

GENE-TRAK Systems, Framingham, MA—508-872-3113, Booth #35

DNA probe tests for the detection of foodborne pathogens such as *Salmonella, Listeria, E. coli, Staph. aureus, Campylobacter,* and *Yersinia enterocolitica*. Also, Hygicult Agar Slides for monitoring microbiological hygiene, and Boehringer Mannheim food enzymatic test kits.

Gist-brocades Food Ingredients, Inc., King of Prussia, PA—215-272-4040, Booth #22

Gist-brocades Food Ingredients, Inc. will be featuring DELVOTEST®, a standard diffusion test for the determination of antibiotic residues in milk. Gist-brocades also manufacturers of DELVOCID® - mold and yeast inhibitor for cheese, KID and CALF LIPASE - animal lipases, PICCANTASE® - microbial lipase, MAXILACT® - yeast lactose, CHEESE COLOR and MAXIREN® - 100% pure chymosin.

GRiD Systems, Dallas, TX—214-761-1979, Booth #6

GRiD Systems Corporation manufactures and markets a comprehensive range of battery-powered laptop computers, industry standard desktop computers, operating systems, software development tools, portable peripherals and electronic mail/networking systems. GRiD, with installed systems in more than one third of Fortune 500 companies, has a worldwide direct sales and support organization. GRiD Systems Corporation will display its breakthrough handheld computer, GRiDPAD. GRiDPAD is a fully PC and MS-DOS compatible keyboardless computer that accepts hand-printed characters. It weighs 4.5 pounds and is shaped like a clipboard.

IDETEK, Inc., San Bruno, CA—800-IDETEK1, Booth #36

IDETEK is the leader in bringing biotechnology, convenience and reliability to food and dairy quality control. The LacTek™ family of milk antibiotic residue tests is the fastest growing product in the industry. All LacTek kits use the exact same procedure and can be run simultaneously. The inexpensive LacStation II™ allows a total test time of only 7 minutes, with actual hands-on test time of just under 2 minutes. The equipment takes the guess work out of reading the tests and provides a printed record of the test results.

IDEXX Corporation, Portland, ME—207-774-4334, Booth #50

IDEXX is a leading biodetection company that markets over 40 diagnostic products. Stop by to see our line of quality assurance diagnostics for Beta-Lactams, Gentamicin, Tetracyclines, Sulfamethazine, Sulfadimethoxine, Sulfathiazole, Aflatoxin M_1, and Aflatoxin B_1. Also, we will display the PROREADER, an optical reader designed specifically to read all CITE PROBE tests.

Integrated BioSolutions, Inc., Monmouth Junction, NJ—908-274-1778, Booth # 29

Hazard Analysis Critical Control Point monitoring (HACCP) has been difficult to manage from a microbiological standpoint. The Lumac BioCounter provides a rapid indication (within two minutes) of line hygiene, raw material and finished product quality bringing the HACCP concept into reality. Also on display will be the highly successful Q.A. MicroKit designed for differential contact surface testing and biocide efficacy, and a new line of products developed for rapid and accurate screening of *Salmonella*.

KLENZADE, A Service of Ecolab Inc., St. Paul, MN—612-293-2233, Booth # 32

Klenzade, A Service of Ecolab Inc., is the market leader in sanitation products, programs and services for the dairy, beverage and food processing industries. The complete line of products include proprietary, innovative solid products, such as sanitizers, lubricants and cleaners, and Ononia Active, peroxyacetic acid sanitizer. Klenzade Engineering provides in-house expertise and single service solutions for CIP systems and controls and monitoring.

Lincoln Suppliers, Inc., Owatonna, MN—800-622-8425, Booth # 34

Wholesale Distributor of processing equipment for the Dairy and Food Industry. Manufacturer of milk sample vials and vial accessories. Lincoln Suppliers will display snap-cap and hinge cap vials, vinyl coated racks, conveyor trays and styro shippers.

Meritech, Inc., Tempe, AZ—800-932-7707, Booth #61

Introducing the SaniTech™ 2000 Hand Sanitizing System. SaniTech provides state-of-the-art protection from the dangers of hand transmitted foodborne illnesses. It will help prevent the spreading of such diseases as hepatitis and salmonella. It is the best, low cost insurance you can not afford to be without. Come see us at the 78th Annual Meeting of IAMFES to experience the "Invigorating" massage like wash.

Microbac Laboratories, Inc., Pittsburgh, PA—412-369-9900, Booth # 25

Microbac Laboratories, Inc. is a full-service environmental testing company, providing quality analyses to schools, industries, commercial businesses and homeowners for the past 20 years. Our staff consists of over 150 highly-qualified chemists, microbiologists, sampling technicians, asbestos inspectors, food technologists, sanitation inspectors and other environmental specialists. Microbac's multiple locations (18 laboratories nationwide) allow us to effectively provide food-bourne illness investigations, hazardous waste sampling and analyses, drinking water testing, and other services to address areas of concern to the IAMFES membership. Each laboratory adheres to strict quality control protocols to assure accurate testing results. We can also perform analyses to

assist you in the quality control of your own laboratory. Our Technical Service Representatives will be available throughout the IAMFES Annual Meeting to answer any questions you may have about Microbac's services.

Micro Diagnostics, Inc., Addison, IL—708-628-6055, Booth #46

Manufacturer of prepared culture media servicing the needs of microbiologists and laboratory technicians. Our reputation for producing superior quality products at competitive prices and being a dependable supplier are well established. We also provide dehydrated media, microbiological supplies and equipment. Custom services for your specific needs are available; specialty formulations, special packaging requirements and custom quality control procedures.

Minnesota Valley Testing Laboratories, New Ulm, MN —507-354-8517, Booth #20

Established in 1951, MVTL is an independent laboratory which offers confidential microbiological and chemical analyses of food, water, agricultural and environmental samples. These include: *Listeria*, *Salmonella*, *E. coli*, proximates, dry milk grading, nutritional labeling, fatty acid profiles, cholesterol, minerals, metals, vitamins, sulfa drugs in poultry tissue, water and wastewater analyses, waste oil, fuel, and sludge analyses; overburden and soil analyses. Our capabilities extend beyond this list. MVTL offers fast and reliable service at competitive prices.

Nasco International, Fort Atkinson, WI—414-563-2446, Booth #8

Nasco is a manufacturer of the internationally known Whirl-Pak sampling bag, and related sampling products. Whirl-Pak bags have been on the market for over 30 years and are available in a wide range of sizes for a large variety of uses. Whirl-Pak features a new "Puncture Proof Tab" eliminating the possibility of the tab piercing another bag. Whirl-Pak bags are actually sterilized in a separate operation, with documentation on each batch. With it's unique closing system, which prevents leakage, the Whirl-Pak bag is recognized as the standard in the industry.

Nelson-Jameson, Inc., Marshfield, WI—800-826-8302, Booth # 58

A food and dairy laboratory specialist, Nelson-Jameson, Inc. distributes the RCS Centrifugal Air Sampler and other environmental sampling aids. Products selected by Nelson-Jameson provide users with accurate results using proven technology without the hassles of involved preparations. These and hundreds of other supplies are stocked for immediate shipment. For a free catalog, call (800) 826-8302 or (715) 387-1151.

Organon Teknika Corporation, Durham, NC—919-620-2353, Booth #5

Organon Teknika Corporation will feature its ELISA-based rapid testing system for *Listeria* and *Salmonella*. Rapid ELISA testing is one of the most reliable systems available, providing accuracy, objective results, and savings of time and money.

Plastic Packaging Concepts, Inc., Eaton, IN—800-333-3086, Booth #59

Plastic Packaging Concepts, Inc. manufactures Mojonnier Sample Bags and will be exhibiting our complete line. Mojonnier sterilized bags are used world wide for all types of sample collection and transportation. We will also be featuring bags for use in the Stomacher™ Lab Blender. These top quality, heavy duty bags have been specially designed to eliminate lost samples and wasted time due to bag leakage during blending. Mojonnier bags are available in "Jumbo" sizes for your extra large sampling needs. We have a bag for your sampling requirements or we can probably make one for you. Visit us in Louisville or call 800-333-3086

Polar Tech Industries, Inc., Elgin, IL—708-697-1400, Booth # 43

ICE BRIX gel refrigerants - leakproof and reusable. RE-FREEZ-R-BRIX - Foam refrigerant - rigid shape and reusable. Both come in a variety of sizes and work to extend shipping times of products. THERMO CHILL Insulated shippers and mailers. Engineered to be lightweight, one piece, molded EPS foam for dependable insulation. Packaging you can trust for safe shipment of temperature sensitive products. Complete line of in-stock models and refrigerant packs.

Promega Corporation, Madison, WI—608-274-4330, Booth # 45

A leading biotechnology company, Promega Corporation now offers two new tests for quick screening of milk. The new Enliten™ Milk Total Viable Organisms Assay detects all microbes, including bacteria, yeasts and molds. It is especially useful in detecting psychrophiles (cold growing bacteria). The Enliten™ Direct Microscopic Count Assay for Milk permits rapid screening of raw milk in 10 minutes or less and is both easier to perform and more accurate than standard DMC procedures.

Q Laboratories, Inc., Cincinnati, OH—513-662-1300, Booth # 48

Q Laboratories, Inc. is an independent testing and consulting laboratory, providing microbiological and analytical chemistry support to the food, beverage, cosmetic, pharmaceutical, and medical device industries. Services include QC/release testing, antimicrobial efficacy testing, GMP testing, plant sanitation audits (HACCP approach), nutritional labeling, Barrier testing, preservative analysis, shelf-life studies, and complete pathogen testing. Q Laboratories' Research and Development division provides analyst training and education programs in compendial and rapid methodologies, provides product and method development services, and designs and implements check sample programs for corporate quality assurance. Q Laboratories' professional staff offers complete services in protocol design and implementation of collaborative studies.

R-TECH, Minneapolis, MN—612-481-2583, Booth #60

R-TECH is contract research fast and economical with over 150 scientists, technicians, and engineers supporting your needs. R-TECH offers contract research in the areas of: analytical services, sensory evaluation, test kitchen services (dairy, meats, bakery, aseptic), application, exploratory, engineering (packaging, process, industrial, energy management, environmental, project management, design) quality control, regulatory affairs, specification services.

R & D Laboratory, Columbus, OH—800-228-4865, Booth # 3

R & D Laboratory will be distributing free copies of their current catalog which lists their complete line of tests as well as current prices. R & D is a full-service laboratory which offers both microbiological and chemical testing to the food and dairy industries. Since 1949 we have assisted those companies who share a concern for quality with the testing of their products and raw ingredients. Our experienced personnel will also assist your firm in setting quality control standards or in the implementation of quality control procedures.

Radiometer America, Inc./Malthus Division, Westlake, OH—216-871-8900, Booth # 40

Featuring the Malthus rapid microbiology product line:
- Malthus 2000 Systems - for routine quality assurance and/or research and development, capable of utilizing both reusable and disposable cells.
- Malthus 1000S Systems - for rapid *Salmonella* detection, utilizing disposable cells.

- Malthus Disposable Salmonella Cells - available in pre-filled with sterilized media. - Malthus Disposable CO_2 Cells - for an alternative way to measure microbial growth, monitoring production of CO_2.

REMEL, Lenexa, KS—800-255-6730, Booth #27

REMEL is a leading manufacturer of microbiology products, including prepared culture media, stains, reagents, diagnostic tests, environmental testing products, and other related products. Custom formulations are invited.

SHAT-R-SHIELD, Salisbury, NC—704-633-2100, Booth # 42

Plastic-coated, shatter-proof lamps. The coating will contain virtually all glass thus protecting employees, work area and production. Food and equipment will not be contaminated by glass, phosphors or mercury.

Silliker Laboratories Group, Inc. Chicago Heights, IL—708-756-3210, Booth #31

The SILLIKER Advantage. SILLIKER LABORATORIES GROUP, INC., an internationally respected network of laboratories, offers a comprehensive spectrum of services designed to help ensure the safety and quality of your food product. Quality services include confidential microbiological, chemical, and nutritional analyses, water and hazard analyses; Testing for extraneous matter, pesticide residues, and trace metals; Custom design, client-sponsored research programs; Shelf-life studies; Consultation and problem-solving; Sampling programs; Quality control programs; HACCP programs; Food plant sanitation audits; Food poisoning investigations; Food safety education and training programs; Microbiology short courses. Open 365 days a year, Silliker's network of laboratories include labs in Chicago Heights, IL; Hayward, CA, Carson, CA; Columbus, OH; Stone Mountain, GA; Garwood, NJ; Sinking Spring, PA; Dallas/Fort Worth, College Station and San Antonio, TX; and Mississauga, Ontario. Stop by our booth and put our technical experience, professionalism, and responsiveness to work for you.

SmithKline Beecham Animal Health, Exton, PA—215-363-3757, Booth #14

SmithKline Beecham Animal Health offers technology to enable food and milk processors to test products for aflatoxin and antibiotic residues. The Signal AccuCup Aflatoxin Test screens to 20 ppb aflatoxin contamination in corn, feed, raw and roasted peanuts. The Penzyme III Antibiotic Residue Test detects beta-lactam antibiotics in milk. The Signal ForeSite Sulfamethazine or Gentamicin Tests can be run on milk, tissue, serum or feed to detect these residues in four minutes.

Tekmar Company, Cincinnati, OH—513-247-7000, Booth #55

Stomacher Lab Blender - Food Microbiology: The Stomacher may be used for bacterial counts in food samples including fruits, grains, meats, and dairy products. Damage to microbial cells and tissues is minimal. A temperature rise in the sampling is reduced during blending. Features: No sample cross contamination; no machine clean up; fast operation.

3-A Sanitary Standards Symbol Administrative Council, Cedar Rapids, IA—319-395-9151, Booth #23

The 3-A Sanitary Standards Symbol Administrative Council authorizes equipment manufacturers to display the 3-A Symbol on equipment which complies with existing 3-A Sanitary Standards. The 3-A Symbol is recognized world wide as a mark of excellence on Dairy and Food Processing equipment. Information on the function of the program, its administration and benefits will be available at the 3-A Symbol Council booth.

3M Microbiology Products, St. Paul, MN—612-733-9164, Booth #11

3M Microbiology Products would like to show how you can increase your lab efficiency with Petrifilm™ plates. Also available is the Petrifilm test kit-L for liquid samples, Petrifilm test kit-HEC for hemorrhagic *E. coli* 0157:H7 for testing meat and poultry and the NEW Petrifilm test kit-C for coliform testing in food and dairy products. Each kit contains all elements needed for on-site sample testing. Report™ visual immunoassay kit is the easiest method available for *Salmonella, Listeria* and Staphylococcal Enterotoxin testing.

Trojan, Inc., Mt. Sterling, KY—606-498-0526, Booth #47

Trojan, Inc. manufactures a full line of coated and uncoated incandescent and fluorescent lamps. The incandescent lamps are coated with Teflon, which will withstand up to 500°F, and our frost silicone rubber which are ideal for cooler/freezer applications. Saf-T-Cote fluorescent lamps are coated with our special Polymer coating, offering protection against shattering glass contaminating gases. All of our lamps have USDA approval and comply with FDA and OSHA requirements.

Troy Biologicals, Troy, MI—313-585-9720, Booth #41

Microbiology Products for Industry and Research.

Unipath Co., Oxoid Division, Ogdensburg, NY—800-567-8378, Booth #24

Oxoid is a primary manufacturer of peptones, hydrolysates, dehydrated culture media and supplements for the identification of bacterial micro-organisms. Specifically for *Listeria* and *Salmonella*. Available are Oxford Medium and PALCAM Medium. A range of products for toxin detection by diagnostic kits for Staphylococcal, *E. coli, Bacillus cereus* and toxic shock. A complete Anaerobic System.

Vicam-Aflatest, Somerville, MA—617-623-0030, Booth #17

Vicam is an established Biotechnology company dedicated to ensuring food safety. Vicam will be exhibiting a simple, rapid, sensitive, quantitative test for the detection of *Listeria* and Aflatoxin in foods.

Walker Stainless Equipment Co., Inc., New Lisbon, WI—608-562-3151, Booth #33

Since 1943, Walker Stainless Equipment Company has been a leading manufacturer of quality sanitary stainless steel equipment for the process industries. We manufacture transportation tanks, storage silos, processing tanks, and custom equipment for dairy, food pharmaceutical, beverage, chemical, biotechnical, nuclear and semiconductor applications.

Weber Scientific, East Windsor, NJ—609-452-0443, Booth #21

We will be distributing copies of our brand new 72-page catalog dedicated to water, wastewater, dairy and food analysis. Also featured is a comprehensive selection of sampling supplies, thermometers, pH meters and products for the plant sanitarian. Plus, stop by our booth for your chance to win the fabulous Weber Scientific "Cow Clock"!

IAMFES

International Association of Milk, Food and Environmental Sanitarians, Inc.

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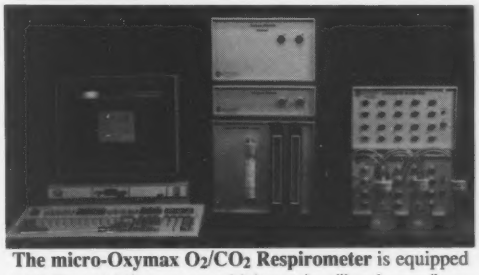

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International Association of Milk, Food and Environmental Sanitarians, Inc.

Prices Effective March 1, 1991

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Qty.		Total $
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_____	Procedures to Investigate Foodborne Illness - new 4th Edition $5.00/member; $7.50/non-member	_____
_____	Procedures to Investigate Arthropod-borne and Rodent-borne Illness $5.00/member; $7.50/non-member	_____

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105	118	131	144	157	170	183	196	209	222	235	248	261	274	287	300	313	326	339	352
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110	123	136	149	162	175	188	201	214	227	240	253	266	279	292	305	318	331	344	357
111	124	137	150	163	176	189	202	215	228	241	254	267	280	293	306	319	332	345	358
112	125	138	151	164	177	190	203	216	229	242	255	268	281	294	307	320	333	346	359
113	126	139	152	165	178	191	204	217	230	243	256	269	282	295	308	321	334	347	360

This second Reader Service Card is provided to allow co-workers to also respond to companies of interest.

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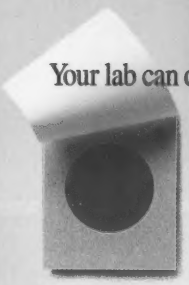

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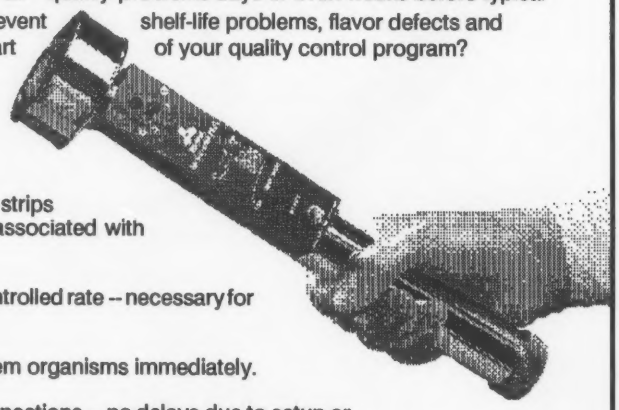

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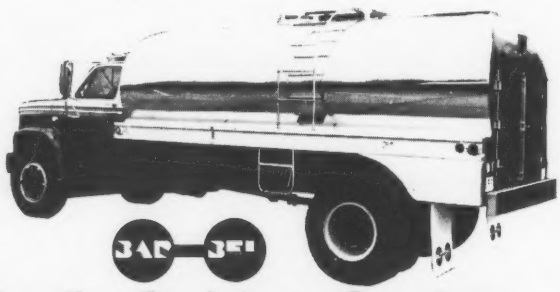

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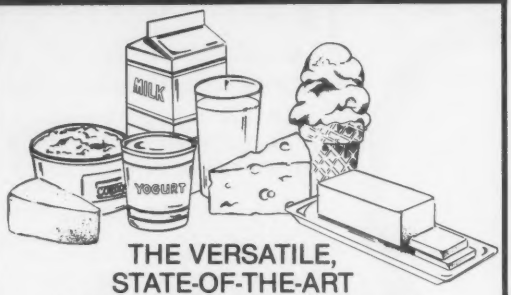

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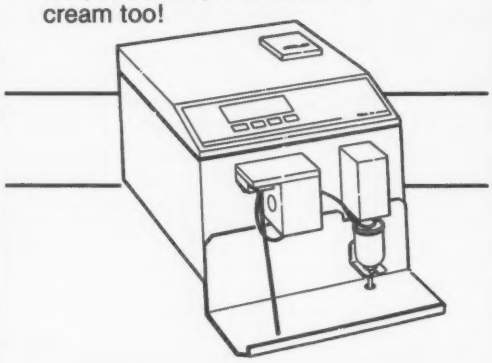

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Coming Events

1991

August

•**4-6, The Pennsylvania Bakers Association 1991 Show and Convention** will be held at the Sheraton Resort, Lancaster, PA. For more information contact Tina Baum, Coordinator, PO Box 2467, Mechanicsburg, PA 17055, phone (800)346-7767 or (717)697-4199, FAX (717)790-9441.

•**5-9, Biotechnology: Principles and Processes**, will be held at the Massachusetts Institute of Technology, Cambridge, MA. For more information, please contact the Director of Summer Session, MIT, Room E19-356, Cambridge, MA 02139.

•**12-15, 105th Annual International Meeting and Exposition of the Association of Official Analytical Chemists** will be held at The Pointe at South Mountain, Phoenix, Arizona. For more information contact the AOAC, Suite 400, 2200 Wilson Boulevard, Arlington, VA 22201-3301; (703)522-3032; FAX (703)522-5468.

•**13-14, Food Plant Sanitation Workshop**, sponsored by the American Institute of Baking, will be held in Cherry Hill, NJ. For more information contact AIB at (913)537-4750 or (800)633-5137.

•**13-14, Food Plant Sanitation Workshop**, sponsored by the American Institute of Baking, will be held in San Jose, CA. For more information contact AIB at (913)537-4750 or (800)633-5137.

•**20-21, Food Plant Sanitation Workshop**, sponsored by the American Institute of Baking, will be held in Cherry Hill, NJ. For more information contact AIB at (913)537-4750 or (800)633-5137.

September

•**9-13, Basic Food Microbiology Short Course**, sponsored by the University of California, will be held at the Food Science and Technology Department, Cruess Hall, UC Davis Campus. For further information contact Robert J. Price, Food Science and Technology, University of California, Davis, CA 95616-8598; (916)752-2194.

•**10-11, Marketing Development Seminar** will be held at The Registry, Denver, CO. For more information contact the International Dairy Foods Association, 888 Sixteenth Street, NW, Washington, DC 20006; (202)296-4250.

•**10-11, Food Plant Sanitation Workshop**, sponsored by the American Institute of Baking, will be held in Chicago, IL. For more information contact AIB at (913)537-4750 or (800)633-5137.

•**10-12, Texas Association of Milk, Food and Environmental Sanitarians** will hold a seminar entitled "Special Problems in Milk Plants" at the Howard Johnson, Plaza South, IH 35 at Woodward, Austin, TX. For more information contact Janie Park of TAMFES at (512)458-7281.

•**10-12, Western Packaging Exposition** to be held at the Anaheim Convention Center, Anaheim, CA 92802. For more information contact Debra Lee, Public Relations Manager, at (203)352-8297.

•**12, Mississippi Association of Sanitarians, Inc.** will hold a mini-conference in Tupelo, MS. For further information contact Greg Geno, MS State Department of Health, 101 First Street, Booneville, MS 38829.

•**16-20, Wyoming Public Health Sanitarians Association** will hold their Annual Meeting at the Holiday Inn, Cheyenne, WY. For further information contact Terry Carlile, Box 1182, Laramie, WY 82070; (307)742-3611.

•**19-21, The New Jersey Dietetic Association, Inc.** will hold its 59th Annual Meeting, "Navigating the Nineties", at the Ocean Place Hilton Resort and Spa in Long Branch, New Jersey. For more information contact NJDA at 180 Township Line Road, Belle Mead, NJ 08502 or call (908)359-1184.

•**24-26, New York State Association of Milk and Food Sanitarians 68th Annual Conference** will be held at the Sheraton Inn, Liverpool, NY (Syracuse). For more information contact Paul Dersam at (716)937-3432.

•**25-26, Wisconsin Association of Milk and Food Sanitarians, Wisconsin Environmental Health Association and Wisconsin Dairy Plant Fieldmen's Association Joint Education Conference** will be held at the Maritime Inn, Manitowoc, WI. For further information contact Neil M. Vassau, Publicity Chairman, P.O. Box 7883, Madison, WI 53707; (608)267-3504.

•**25-27, BIOTECH USA '91** will be held at the Philadelphia Civic Center, Philadelphia, PA. For more information contact Gina Amatruda at (203)852-0500, ext. 266.

•**29-Oct. 4, 8th World Congress of Food Science and Technology**. The Westin Harbor Castle, Toronto, Canada. For further information, please write 8th World Congress, (IUFoST), 3340 Orlando Drive, Mississauga, Ontario, Canada L4V 1C7; or FAX (416)678-1229.

October

•**1-2, Food Plant Sanitation Workshop**, sponsored by the American Institute of Baking, will be held in Toronto, Ontario, Canada. For more information contact AIB at (913)537-4750 or (800)633-5137.

•**1-4, Canadian Institute of Public Health Inspectors Annual Conference**. For further information contact John Foruna, Public Health Inspector at Hamilton-Wentworth Regional Department of Public Health Services, P. O. Box 897, Hamilton, Ontario, Canada, L8N 3P6; (416)546-3570 or FAX (416)521-8093.

•**2-4, South Dakota Environmental Health Association** will hold its Annual Meeting at the Howard Johnson Hotel, Rapid City, SD. For more information call Dave Micklos, SD State Department of Health, (605)773-3364.

•**2-5, National Society for Healthcare Foodservice Management's Third National Conference** will be held at the Washington Court Hotel on Capitol Hill, Washington, DC. For more information call or write the National Society for Healthcare Foodservice Management, 204 E. Street, NE, Washington, DC 20002; (202)546-7236.

•**2, National Automatic Merchandising Association's Pre-Convention Early Education Sessions**, Chicago, IL. For further information contact NAMA Convention Department at (312)346-0370.

•**3-5, National Automatic Merchandising Association's** National Convention, Trade Show and Education Sessions for Vending/Foodservice Management, will be held at the McCormick Place, Chicago, IL. For further information contact NAMA Convention Department at (312)346-0370.

•**6-9, Annual Meeting and Convention: Milk Industry Foundation and International Ice Cream Association** will be held at the Marriott River Center, San Antonio, TX. For more information contact the International Dairy Foods Association, 888 Sixteenth Street, NW, Washington, DC 20006; (202)296-4250.

•**6-9, The 1991 National Frozen Food Convention and Exposition**, sponsored by The National Frozen Food Association and the American Frozen Food Institute, will be held in Orlando, FL. For more information contact the National Frozen Food Association, 4755 Linglestown Road, Suite 300, Harrisburg, PA 17112, (717)657-8601, or the American Frozen Food Institute, 1764 Old Meadow Lane, Suite 350, McLean, VA 22102, (703)821-0770.

•**16-17, Iowa Association of Milk, Food and Environmental Sanitarians, Inc. 50th Anniversary Annual Meeting** will be held at the Ramada Inn, Waterloo, IA. For more information contact Dale Cooper (312)927-3212.

•**16-17, Annual Conference of the North Central Cheese Industries Association** will be held at the Earle Brown Center, University of Minnesota, St. Paul. For further information contact E. A. Zottola, Executive Secretary, NCCIA, P. O. Box 8113, St. Paul, MN 55108.

•**16-17, Cheese Symposium and California Dairy Food Research Center Annual Conference** will be held at the University of California, Davis, CA. For more information please contact Bob Pearl/Sharon Munowitch, University Extension, University of California, Davis, CA 95616 or call (916)757-8899.

•**20-Nov. 2, National Fisheries Institute 46th Annual Convention** will be held at the New Orleans Marriott, New Orleans, LA. Contact the NFI at (703)524-8881 for more information.

•**26-30, Food & Dairy Expo 91,** sponsored by Dairy & Food Industries Supply Association, to be held at the McCormick Place, Chicago. For more information contact DFISA, 6245 Executive Boulevard, Rockville, MD 20852-3938 (301)984-1444.

•**29-30, Dairy Food Processors' Symposium** will be held at the Palmer House, Chicago, IL. For more information contact the International Dairy Foods Association, 888 Sixteenth Street, NW, Washington, DC 20006; (202)296-4250.

To insure that your meeting time is published, send announcements at least 90 days in advance to: IAMFES, 502 E. Lincoln Way, Ames, IA 50010-6666.

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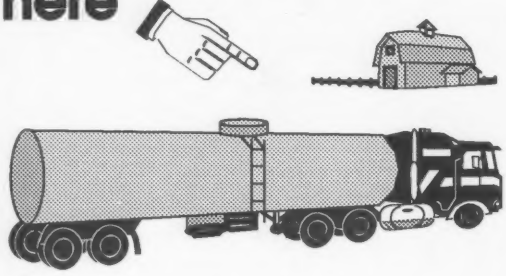

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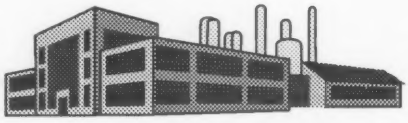

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